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The Longevity of Typhoid Fever Germs.

Sanitary engineers always welcome new data to throw further light on the life of typhoid bacilli in sewage and water. The importance of this question in many problems of water supply, sewage disposal and self-purification of streams easily accounts for this interest. For some fifteen years the general views of prominent workers in this field remained about the same and were based upon the results of numerous experiments made in the laboratory upon the life of typhoid fever germs in various waters. These experiments, made both in Europe and in this country, notably at the Lawrence Experiment Station, were quite harmonious on the whole. They indicated that typhoid fever germs do not apparently under any conditions in practice multiply in water, but, on the contrary, that they die out gradually, with a small but varying percentage of these bacilli living for periods of from one to three weeks or more, depending partly upon the shortcomings of labortory methods and partly on local conditions, the full significance of which is not understood.

Independently of laboratory experiments, engineers for some years have appreciated that typhoid fever germs in fecal matter may live under some circumstances for several months or longer, especially during cold weather. This has been demonstrated conclusively by some of the unfortunate typhoid fever epidemics which have occurred in various cities, among which may be mentioned the one at York, Pa., in 1897, and the one at New Haven, Conn., in 1901. Under some conditions, especially in the soil, it is manifest that some typhoid fever germs can and do live for many months. Indeed, it is obvious that in some way these bacilli perpetuate themselves for quite long periods, sufficient to keep the disease from becoming exterminated in rural districts.

Last year the results of extensive experiments upon the life of typhoid fever germs in various waters associated with the Chicago Drainage Canal project were published by Drs. Jordan, Russell and Zeit. The results of these experiments were reviewed in connection with other similar data by Mr. George C. Whipple, in The Engineering Record of Dec. 24, 1904. In brief, the experiments of these three gentlemen embodied technique by which improvements appeared to have been made through the use of collodion or parchment sacs for containers in place of bottles such as were formerly used for this purpose. It was claimed by these and other investigators that experiments made with samples of water inoculated with typhoid fever bacilli and allowed to stand in glass bottles do not correspond with conditions in practice in that the typhoid bacilli do not have access to fresh water or fresh bacteria; but that they remain in contact with bacteria and their products within the bottle, and in this way the antagonism of ordinary water bacteria toward typhoid bacilli is materially reduced. Consequently it was claimed that the longevity of the typhoid bacilli, as tested in glass bottles, was greater than under actual natural conditions.

These experiments led the authors to conclude that in the local waters the vast majority of typhoid fever germs perished in three to four days. Although they disclaim the applicability of these data to all other conditions in natural bodies of water, the obvious influence of such data assigning an unusually short life to these germs is to make some people less conservative than formerly regarding the vital question of typhoid fever infection through drinking water. Indeed, several instances appear to have recently occurred where sanitarians, as a result of these investigations, have tacitly consented, or at least have not objected, to procedures which ordinarily would be vigorously protested against by those experienced in matters of public water supply.

Among the several incidental features of interest and importance which developed at the symposium on copper sulphate treatment at the New England water works convention last week were the remarks of Mr. George A. Johnson in reference to certain investigations forming a portion of the various tests made under his immediate charge during the past year at the Sewage Testing Station at Columbus. His remarks in connection with the permeability of parchment sacs appear on page 344 of this issue and bring clearly to the front the question of the reliability of experiments made with such sacs in studying the life of typhoid fever germs in water.

In brief, he showed that unpunctured sacs which maintained their initial integrity throughout the tests, so far as dialyzing properties are concerned, were unable to prevent motile bacteria from passing through the walls of the sacs. Details of the technique employed by him and his associates were concisely outlined and apparently offer a plausible explanation, in part at least, of why experiments on the life of typhoid bacteria conducted in this way point to the conclusions so different from those generally held previously. The manner in which motile bacteria are able to pass through such sac walls is not perfectly clear, but it is not necessary to explain in minute detail all of the various scientific factors involved in such passage. There remains the fact that apparently with the most careful technique typhoid fever germs are able to pass from collodion sacs, thus throwing serious doubt upon the alleged short life of the typhoid fever germs supposed to have remained and died within the sac.

For some time it has been known that unpunctured sacs are not necessarily germ tight. This was supposed to be due initially to defective sacs. The Columbus observations indicate that this difficulty is not as easily guarded against and prevented uniformly as was supposed, and that sound data from the use of sacs involves the necessity of establishing the integrity of each sac against the passage of motile bacteria not only at the beginning but at the end of the test. Another point of significance was brought out both by Mr. D. D. Jackson, of Brooklyn, and Mr. Johnson, namely, that ordinary laboratory cultures of typhoid fever germs become debilitated, and, compared with virulent germs just removed from the animal body, are much more readily killed by natural causes as well as by the copper sulphate treatment.

Further investigations along this important line will no doubt bring added information, but in the meantime it seems prudent for sanitary engineers not to readjust too quickly their views held for a dozen years or more on this question, and not to allow needless risks to be taken on the basis of tests which do not seem to have reached a solid foundation.

Steam Piping.

It is interesting to observe in the plans of central stations the tendency toward essential uniformity in designs for piping for high-pressure saturated steam. Not so many years ago duplicate mains were generally considered necessary, and the pipe-work in a power plant was sometimes a net of lines which must have been as confusing to the operating engineer as they were profitable to the contractor. Where so many lines were deemed desirable, there was naturally a wide range of possible arrangements for them, and no standardization was practicable. A few engineers had their pet systems, which afforded subjects for animated discussions before engineering societies and in technical journals, but as a rule each case was worked out quite independently and without much regard for any other consideration than reliability in operation. Finally a number of leading engineers discovered about the same time that they had been wasting a lot of money. The duplicate mains were never used in case the principal line was designed and put up properly in the first place, and the duplication was an unwarranted and expensive precaution. Accordingly, without saying anything about it, they did away with the reserve main and studied hard to design an absolutely reliable single system of piping. The saving due to the elimination of the duplicate main was great enough to warrant spending plenty of money for its substitute, a really safe single system. High-grade steam piping very soon became standardized under these conditions, and contractors for it who appreciated the vital importance of good materials and workmanship have built up a lucrative business.

Unfortunately there is one branch of the piping situation to-day that does not show the same progress, except where good engineering knowledge has been secured for both planning and supervising installations. The mechanical equipment in apartment buildings is particularly likely to contain examples of this unsatisfactory work. In many of these buildings the mechanical equipment is quite elaborate, with independent electric, refrigerating and heating apparatus and elevators. It is the usual custom to turn the design of such equipment for office buildings over to engineering specialists, but when the plant is for use in apartment houses it is practically left to the mercy of the general contractors in many cases. These contractors have no intention of putting in poor work, but the probability is that they will do so. The installations are too often made by men whose training has been gained solely in heating work. They fail to appreciate the great difference between heating mains and high-pressure steam piping, and consequently put up work which it is impossible to keep tight. Moreover they jam together the pumps, engines and other equipment in such a way that repairs are very difficult and renewals impossible without shutting down the whole plant. There is one costly building of this type in New York, put up by prominent builders who were directed by the owners to spare no expense in the way of equipment which would be the most economical in the long run. The owners are large property holders with long experience with valuable office buildings, and appreciated the importance of good design and workmanship in the mechanical equipment of their structures. Although the builders had an entirely free hand in this work, their steam piping has leaked so badly that a second flooring with air space has been laid on the ground floor of the building to keep down the heat from the basement, and nobody has yet discovered any way of making necessary repairs to the equipment without shutting off all service to the tenants. A better example of the importance of putting the design and installation of such work under a competent engineer it would be difficult to find, although similar instances in less expensive buildings can doubtless be found by the score. In short, the steam piping in any building where high-pressure steam is used is sufficiently important to demand the services of a competent specialist in its design. This work ought to be as well standardized as central station piping, and until it is there will be lots of money wasted and a host of unhappy landlords.

One peculiar feature of the situation is the way in which architects turn over the detail design of such mechanical plants to the contractors. The best of the contractors do not like to do this engineering work but it is forced on them. The less conscientious contractors like the practice because the detailed plans and specifications they prepare open the way for large profits.

The introduction of superheated steam is causing a great deal of renewed attention to piping problems, and it is safe to say that nobody is very well satisfied with the designs up to date. Complaints are many that valves cannot be kept tight with steam highly superheated, and valve makers are now experimenting with metals which will be equally satisfactory at low and high temperatures. Expansion has also taken on greater significance since superheating has become more common, and ideas concerning pipe insulation need revision. These considerations have particular weight where the station load fluctuates rapidly, for in such cases the present inability to control superheating may result in all the piping becoming excessively heated. These new problems will unquestionably be solved in the course of time, but until they are it is safe to say no single detail in a station using superheated steam is deserving of so much careful study as the main piping with its fittings.

The Determination of Stresses by Models.

The use of models as checks in the determination of stresses in engineering structures or for determining the stability of such structures was common in English engineering practice within the memory of many engineers who do not consider themselves very old, while American engineers, even in the early days of their practice, have depended wholly upon computations. Indeed, it was but a comparatively few years ago that an English contracting firm erected nearly or quite half of a great cantilever structure, destined to be set up in India, in order to test the accuracy with which it had been manufactured and thus to avoid the hazard of misfitting in the field. As processes of manufacturing have been improved, and as experience with completed structures has shown the safety of rational design, the use of models has been largely abandoned, although they are still occasionally employed, especially for laboratory work in the manner indicated in The Engineering Record of Sept. 9 of the current year.

In this instance certain interesting experiments were made by Messrs. J. S. Wilson and W. Gore to determine the distribution of stresses in the model of a dam subjected to the action of forces intended to represent accurately the results of water pressure against a masonry dam, the water surface being supposed flush with the top of the masonry. The model was seven inches high and four inches wide or thick at the base, the forces being applied to the dam by means of weights and cords. The internal stresses developed in the rubber model were ingeniously recorded by photographing lines drawn on the rubber surface, originally straight, but distorted under loading so as to represent the internal stresses of tension, compression and shearing, all as fully indicated in the article mentioned.

Such results determined by experimenting with miniature models are certainly interesting and possess some value, but they are like many other results of laboratory work, they must be interpreted with care and must not be too readily applied to great engineering structures composed of material of different character and subjected to forces in a different manner, on a far greater scale and under conditions vastly less simple. Neither the material of the rubber model nor that of a high masonry dam is perfectly homogeneous. Nor is the application of pressure to the upstream face of the model strictly equivalent to the water pressure on the upstream face of a masonry dam. The latter is perfectly continuous, the former is not, resulting in violent disturbances of the condition of internal stress at each break in the uniformity of the external pressure. Again, the sloping upstream face of a high masonry dam is subjected to the weight of a considerable mass of water which may rationally be neglected in the design of the cross section of the dam in such a way as to produce an error on the side of safety, but which nevertheless will have a material effect upon the vertical pressures in a horizontal section of the mass. Finally, in some cases the upward pressure of water which finds its way under the foundation of the dam is sufficient in amount to make its recognition a necessity.

These elements of loading of masonry dams may be sufficient to be controlling in a scheme of determination of stress conditions, whether by analytical methods or by models. They may properly be omitted in the design of dams since the operation of design must in the final instance be approximate, provided the resulting errors are those of safety and not of danger, but they must not be omitted in a pure stress investigation unless the omission is recognized and its general effect indicated. It is not the purpose of these observations to minimize the importance of laboratory or small scale investigations, for they have their proper field and their results may be of great value, but it is intended to set forth in a clear and positive manner the imperative necessity, if error is to be avoided, of recognizing the substantial differences between the conditions of a laboratory test and those of an actual engineering structure. There are many questions connected with the stress conditions in a masonry dam whose answers would be of material service in the designs of that class of structures, but it is to be apprehended that laboratory conditions must be attained much closer to those of nature than in the investigations of Messrs. Wilson and Gore, before the engineer can feel that he has reliable data at his disposal.

The existence of shears in the horizontal planes of the rubber model is one of the most interesting results of these investigations. These shearing stresses constitute one of the main elements in the stability of a masonry dam, and they should be recognized in a quantitative manner, precisely as are the limiting vertical pressures. Fortunately, both experience and computations show that when the greatest vertical pressures in the masonry are properly limited by suitable dimensions the shearing stresses are usually safe-guarded; but that condition should be one of reasonably accurate computation and not conjecture.

There are other important questions connected with the stability of dams in regard to which it is to be feared that tests of models will yield little conclusive information. Chief among these perhaps are the stress conditions resulting from a deep flood discharge over a masonry crest. The pressure against the upstream face with a given depth of overflow may be computed with a fair degree of accuracy, but what back-pressure and what relief from the partial vacuum under the falling sheet of water shall be allowed for, are open questions, even where the conditions of backwater may be given. These and other questions bearing not only upon the design of dams, but also upon other classes of engineering structures must be treated, not by models, but by some system of analysis adequate to meet the actual conditions of nature.

Water Rates.

Every now and then some enterprising superintendent of water works will send out to a hundred or more of his fellow superintendents in other cities a circular letter requesting information in regard to their water rates. The rates thus gathered are then often tabulated and published, especially if the tabulated comparison indicates that the rates in the city of the writer of the circular letter are lower than the average of those in other places. An examination of these tabulations of rates reveals surprising variations in the charges for the same kind of fixture in different cities, and in general it is difficult to discover a basis for any fixture rate in the list, save, perhaps, the rate previously charged in some other city, which is, of course, no real guide at all. That fixture rates, however ignorantly established, are, as a rule, not excessive, is indicated by the fact that very few municipally owned plants pay, when all legitimate expenses are fairly charged up, and that water works bonds of private companies are no longer so eagerly sought by investors as they were ten or twenty years ago. But in individual instances fixture rates are often manifestly inequitable. The obvious solution of the difficulty is the adoption of the meter system; but this, if done recklessly or without careful study of all the conditions, may make matters worse instead of better.

In selling water by measurement, if the cost of pumping the water actually taken were the only thing to be considered in determining the fair rate, the problem would be simple enough. Unfortunately, this is far from being the case. With purveyors of gas or of electric current the cost of production forms so large a part of the total expense, and the receipts by meter are so large in proportion to the cost of measurement, that the only feasible way in which to sell gas or electricity is by meter. In a water-works plant, however, the cost of pumping is only a very small fraction of the total annual expense. A very large proportion of this expense is chargeable to what has been aptly termed "the readiness to serve." It is this item which is usually ignored by those unreasoning advocates of the meter system who make for it the broad but partly fallacious claim that by meter the consumer pays for what he gets. The cost of the water meter and its setting is much greater in proportion to the average yearly value of the commodity measured by it than is the case with the gas or electric meter; and the reading, inspection, testing, maintenance, and additional clerical work connected with meter bills, each adds something to the cost of the service; so that the total extra expense due to the presence of the meter is by no means inconsiderable. That a disregard of these facts may readily lead a water-works management into financial difficulties is instanced by the case of a certain municipally owned plant, whose revenues were already inadequate, and where the partial introduction of meters in one year reduced the total gross receipts by 33 per cent., with very slight reduction in water pumped and a large increase in expenses.

On July 1 last The Engineering Record, in an editorial on water-works charges for factory fire protection, suggested a basis for rates for that class of service. The fundamental principles which should govern the establishment of meter rates are the same as those outlined in the editorial referred to and are as follows:

First, the total receipts from all sources should be just sufficient to pay (a) reasonable interest on the investment, (b) annual contribution to sinking fund to retire the investment in a reasonable time, (c) annual contribution to sinking fund for depreciation, on basis of same period, (d) annual operating expenses, including repairs and minor betterments. Second, each consumer should pay his fair share of the foregoing costs.

It was shown in the editorial referred to that the average of estimates made by well-known experts placed the cost of fire protection service at about 50 per cent. of the annual interest and other fixed charges due to construction cost and 20 per cent. of the annual operating expenses, which amounts should be paid partly by general taxation for fire protection and partly by the owners of premises having private fire protection.

The balance of the total yearly receipts, amounting to 50 per cent. of the fixed charges due to construction and 80 per cent. of the operating expenses, should then be made up by water rates from all of the consumers on the mains, and these rates should be so fixed that each consumer should pay as nearly as possible his fair share. It has already been shown that to base the rates simply on the quantity of water taken would not be equitable, for the expense of pumping is only a small fraction of the total expense connected with each service. It is evident, then, that if water is to be sold by meter there should be, first, a minimum meter rate, which should be of itself large enough to take care of all the expenses of every sort fairly chargeable against the particular service, and for this minimum rate the consumer should be allowed enough water for his reasonable general uses. Should he use water in excess of his minimum meter rate he should then be charged for such excess a rate per thousand gallons so fixed that the aggregate of all such excess rates should be sufficient to take care of the additional expense due to the total increase in pumpage, and this additional expense should include not only the cost of pumping the extra water, but all fixed and other charges connected with increasing the water supply and extending the system to meet the added demands on it.

In the average water-works plant the water mains represent the bulk of the construction cost, and the larger part of all fixed charges are due to the presence of the mains. It is believed, therefore, that the fairest basis for the establishment of a minimum meter rate would be to make it proportional to the cost of the mains in front of the premises. This would be somewhat similar to the old custom, still in use in some cities, of charging what are known as frontage rates. But while the minimum should in each individual case be proportional to the frontage rate, it should be large enough in the aggregate to cover all the fixed charges and other operating costs of the works, less the amount fairly chargeable to public and private fire protection.

With minimum meter rates thus fixed, and a proper charge by meter for water in excess of the minimum, the meter system would not only be far more equitable than the fixture rate system, but the saving resulting from reduction of waste would also more than offset its increased cost and make it the more economical for the consumer.

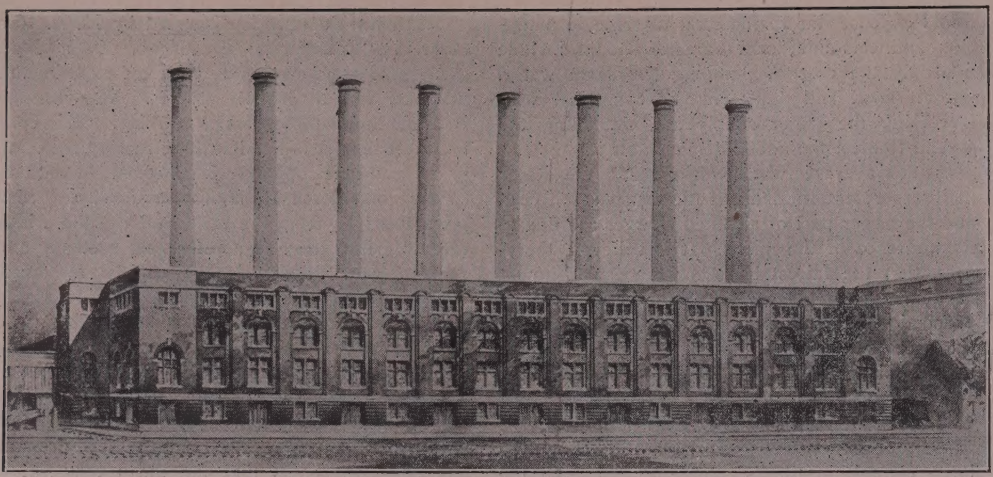
Notes and Comments.

An Intricate Mathematical Solution of some unusual problem in railway curves may appeal strongly to some engineers, but it is questionable whether it is of practical value in most cases. Is it not time, indeed, to acknowledge that much of the mathematics of curve location, as explained in field books, can be replaced to advantage by careful drafting? The analytical methods are satisfactory in the hands of very few people, except for elementary problems, while the graphical methods can be made as accurate as the instrumental work without any trouble. Moreover, the drawing board will enable many complicated locations to be solved even better than by any mathematical analysis, because it shows at a glance the effect of changing any one or several of the conditions. As a matter of fact, graphical solutions are growing in favor, and it would be well to have this fact mentioned in the new editions of field books.

The Wheel Flange Problem confronting street railway managers is one which city engineers must take into account in considering track and pavement subjects. So long as street cars ran only at limited speeds, it was unnecessary for their wheels to have heavy flanges. With the advent of high-speed interurban cars the need of stronger flanges and wider tires, approaching the M. C. B. standard, becomes evident. This in turn will require rails offering a somewhat greater obstruction to vehicles passing over them, and the city engineer, who has had so much trouble with rail sections in the past, seems likely to have still more in the future. The problem is just as difficult for the street railway manager however, for if his rails are rolled with large flangeways the costly special track work will be injured by the small wheels of the city cars. If wheels with larger flanges and wider treads are used on the interurban cars they will ride on their flanges or bear on the pavement to some extent, and thus prove highly uneconomical. The problems involved are so complicated that the city engineer will do well to spend considerable time in the careful study of the subject before he decides applications for permission to use new rail sections solely on the information collected in the past.

The Gas Turbine is discussed by M. A. Barbezat, in "L'Eclairage Electrique," in a paper giving the results of tests with an experimental machine and theoretical studies. The machine is a continuous combustion turbine. The combustion-chamber is lined with refractory material; at one end it is supplied with a continuous stream of air compressed to high pressure by a compressor driven from the turbine-shaft, and within the air orifice there is a jet giving a steady current of petrol which is thus intimately mixed with the air, the mixture is ignited electrically and gives a temperature of about 1,800° Cent. At the other end of the chamber is the nozzle by which the gases are admitted to the blades of the wheel. To prevent damage to the turbine from the high temperature of the gases, another nozzle is fixed supplying steam at low pressure and temperature, so that the mean temperature for any part of the wheel is not injurious. The steam-supply is obtained from water heated in the jackets round the gas-nozzle and passed into a receiver heated by the escaping gases. The author, using coefficients obtained from an experimental machine, discusses the thermodynamic and economic efficiency of this type of turbine, finding values 53.5 and 18 per cent. respectively. He considers that an efficiency of 60 per cent. for the turbine and 80 per cent. for the compressor may soon be attained, and in that case the economic efficiency of the turbine will be increased to 26 per cent.

The Prosecution of Public Works on a business-like basis is threatened by a decision of Justice Bischoff, of the New York Supreme Court. The City of New York greatly needs additional water storage in the Croton valley and the Aqueduct Commission recently let a contract for constructing a reservoir there to MacArthur Bros. & Winston. They were not the lowest bidders, but were fully equipped for immediate work on the largest scale demanded by the conditions, having practically completed the Wachusett dam at Clinton. Rapid construction rather than low cost is the leading requisite in this case. A taxpayer's suit in the interests of the lowest bidder was brought to secure an injunction against further work by this firm, and this injunction was made permanent last week by a decision the gist of which is given in the following extract: "With these provisions in the contract it is impossible to hold that the commissioners have confined themselves to the powers vested in them by the statute. As a guide to and measure of the expense to be incurred—its absolute and necessary office according to the scheme of the act—this contract is practically worthless and serves only as a measure of the scale of compensation to be received by the contractor in his dealings with the commissioners, to whatever extent the latter may deem it advisable to subject the public to expense. This the statute not only fails to authorize, but is distinctly and expressly aimed to prevent." If this is good law, a point that cannot be determined until the Court of Appeals passes on it, then the law ought to be changed as quickly as possible. A great dam can be designed so that all its essential features need not be altered during construction. Nobody can determine definitely, however, what the amounts of material will be in the foundations. The most elaborate borings cannot give information sufficiently definite to warrant an engineer in definitely settling all the details of the foundation before the excavations are completed. The bed rock may prove unsound when exposed to air, it may be deeply fissured, or numerous other conditions may arise changing the total cost of this part of the construction. The only equitable way of meeting this uncertainty is to let the contract on the basis of unit prices.



Delaware Avenue Station, Philadelphia Rapid Transit Co.

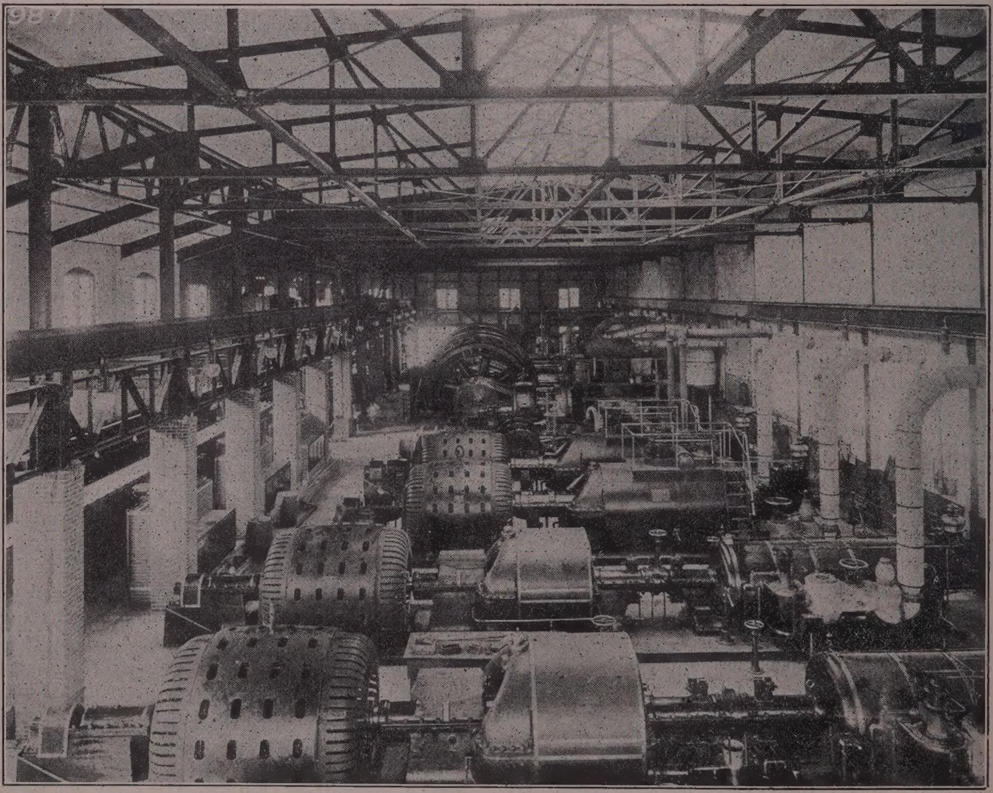
POWER PLANT IMPROVEMENTS OF THE PHILADELPHIA RAPID TRANSIT SYSTEM.

The meeting of the American Street Railway Association in Philadelphia next week makes this an appropriate time to describe the extensive power plant improvements which the Philadelphia Rapid Transit Co. has in hand. These changes began about 1898, when the introduction of heavier cars to meet the increase in traffic made greater power capacity necessary. For a time this need was filled by adding direct-current apparatus at various stations, but in 1903 it was decided to introduce alternating-current equipment. A temporary plant of 2,000 kw was accordingly installed at Second St. and Wyoming Ave., and the next year four 1,500-kw. Westinghouse-Parsons turbo-generators were installed there. It was finally decided to make this a permanent plant, and two more 1,500-kw. Westinghouse-Parsons are now being installed there. This plant is able to care for only a part of the railway system, however, and plans were accordingly drawn for a station of 50,000 kw. capacity at Delaware Ave. and Laurel St., the first work to be an installation of three 6,000-kw. units. Both stations furnish three-phase, 25-cycle, 13,200-volt current. The nine direct-current stations do not call for special comment.

Wyoming Ave. Station.—The reconstructed plant at Second St. and Wyoming Ave. has a 54x267-ft. boiler room and a 70x242-ft. engine room. The former contains six old boilers rated at 600 h.p. each and five batteries of two boilers each; these are of the Parker type and rated at 700 h.p. A test of one of them was printed in The Engineering Record of June 24 of this year. Their special feature, which was shown by the illustrations printed at that time, is the use of a grate at each end and the provision for a reverse circulation of the water as compared with the motion of the gases of combustion. They are equipped with mechanical stokers. There are about 1.36 sq. ft. of floor area per horse-power in this room. A steel stack 14 ft. in diameter and 220 ft. high furnishes draft. The original equipment of the engine room comprised two 28x54x48-in. cross-compound Wetherill engines, each driving a 1,000-kw. General Electric generator, and a 23x40x20-in. Westinghouse compound engine driving a 400-kw. Westinghouse generator. This engine room has been extended at one end for the six 1,500-kw. turbine units, and at the other end for a 23x40x20-in. Westinghouse compound engine with a 400-kw. Westinghouse generator, a Reeves engine driving a 100-kw. Crocker-Wheeler generator, three steam-driven exciter sets and four boiler feed pumps. The engine room has 1.42 sq. ft. per kilowatt capacity.

As originally planned, the plant was intended for reciprocating engine units, two of which were installed before it was decided to alter plans to provide for steam turbines. The plant was designed for the use of saturated steam, but the original boiler equipment is now being modified to accommodate an internal superheater, thus conforming with the new extensions.

The accompanying plan shows in outline the station as it will appear when completed, which will be within the present year. At the present time, however, only four turbine units are in operation, Nos. 3, 4, 5 and 6, with Nos. 1 and 2 engines. The compactness of a steam turbine equipment is well brought out in this plant. Two engine units totaling 2,000 kw. occupy more space than five turbine units totaling 7,500 kw., and nearly as much as the entire 9,000 kw. of turbine machinery, allowing the necessary floor space for the respective units. To some extent this compactness may be accredited to the location of condensers beneath the turbine, so that no extra floor space is necessary for them.



View in Wyoming Avenue and Second Street Station.

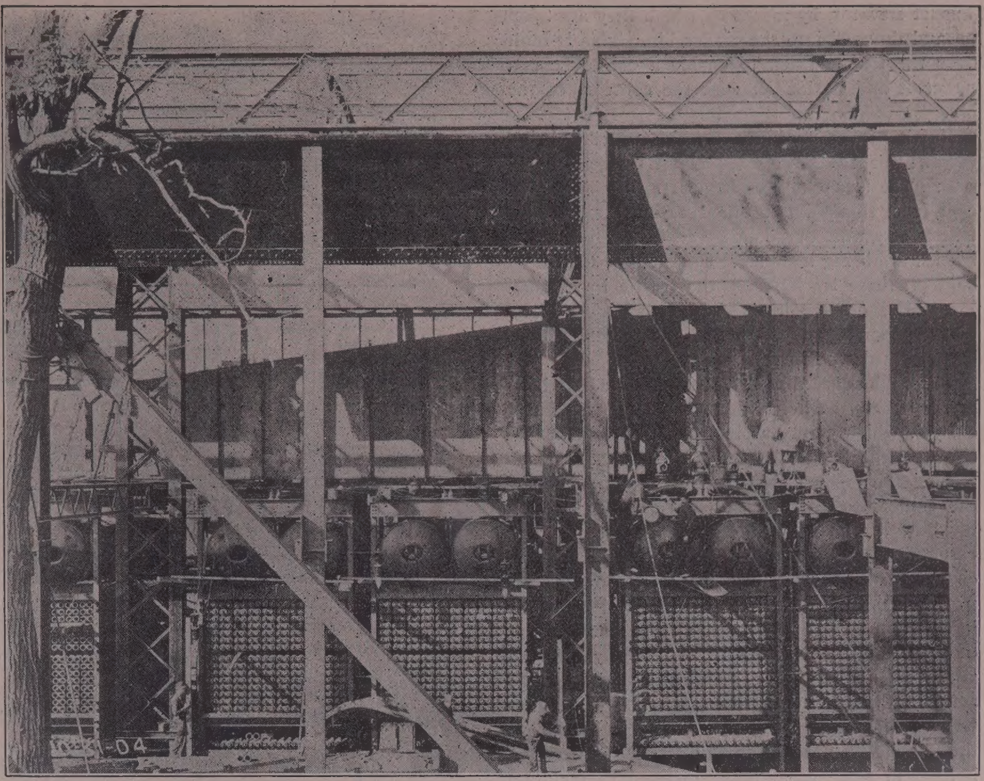
Each turbine unit is supported at the four corners, center and two intermediate points on 12x18-in. and 18x18-in. reinforced concrete pillars 16 ft. high. The base plate is set into the concrete floor which is made integral with the tops of the pillars. This construction leaves the basement remarkably open for the condensing equipment. Water is supplied from a nearby stream through a 4x3½-ft. conduit, and another conduit of the same size serves for the discharge. It was the original intention to have but four turbine units, and when two more were installed it was found necessary to supplement the supply of condensing water. For this purpose the hot water from the condensers is piped to the rear of the station and there cooled by being discharged through spray nozzles into a 144x40-ft. reservoir 11 ft. deep, where it is stored until needed again. The condenser equipment consists of a 3,500-h.p. Alberger barometric condenser for the reciprocating engines, four 1,500-h.p. Alberger dry-vacuum centrifugal condensers taking water from the stream and two similar outfits drawing from the reservoir.

The four turbines already installed gave the following average results in shop tests, using dry saturated steam at 150 lb. pressure. The minimum steam consumption of 13.35 lb. was secured at a trifle over the full load rating. It was impracticable to maintain a 28-in. vacuum on this load, or the result would have been under 13 lb. The average speed variation between half load and 50 per cent. overload was 2.68 per cent., and from no load to full load 2.45 per cent. At about 13.7 per cent. over-speed the automatic stops shut down the machines.

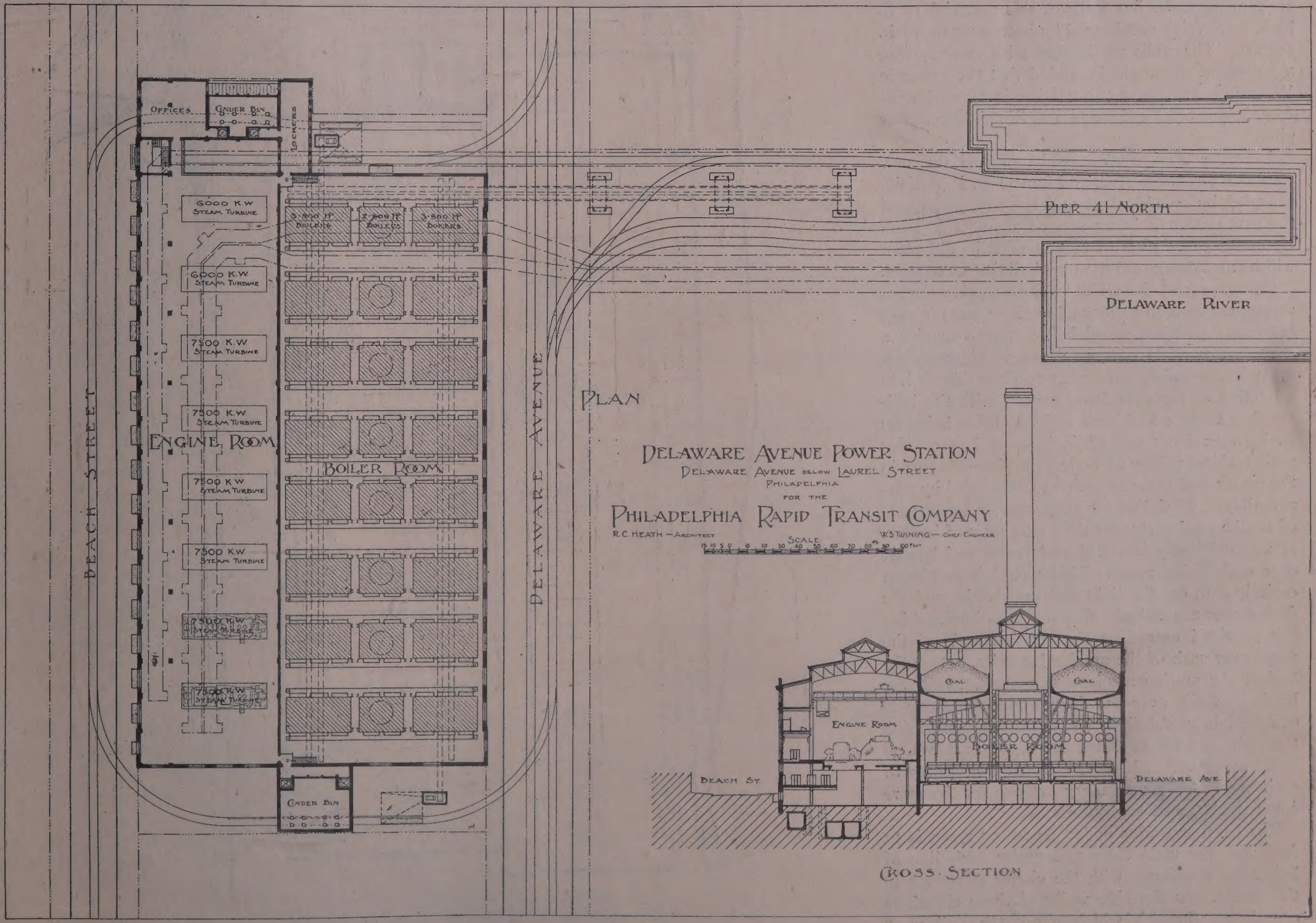
Coal is received on a spur track running into the boiler room. Over the firing space, about 22 ft. wide, in front of the boilers and extending the entire length of the building, is a Berquist suspension bunker with a capacity of 8 tons per linear foot. At the north end of this bunker and under the siding tracks is a reinforced concrete bin with cast-iron pipes leading from it to a pit below the boiler room floor, in which is the boot of a bucket elevator which carries the coal up to a conveyor over the bunker. The coal-elevating and conveying apparatus is of the Link Belt Engineering Co.'s type. The total elevation of coal is about 90 ft. A train of cars can be shifted into the station, and as they are emptied into the bin can be shifted out on the siding to the north. Pipes lead from the bottom of the bunker to the stokers.

The boilers, located on one side only of the house, are spaced 28 ft. center to center. Between these the center row of columns are spaced from which the bunker is suspended; on the wall side the columns are only 14 ft. apart for special reasons, due to the wall and foundation. As the boilers are hand-fired, the coal is drawn off from the bunker on the floor as required. The delivery pipes for the coal are fastened to the lower part of the bunker by a special Berquist valve, so constructed that when the boiler tubes have to be cleaned the valve can be readily closed, retaining the coal in the bin, and the pipes can be taken out, affording ready access to the boiler tubes. The delivery pipes are stopped just far enough above the floor to have a constant supply on hand ready for use without littering the floor with unsightly heaps of coal. The coal-storing and handling scheme at the Wyoming Ave. power house is almost identical to those used by the Philadelphia Rapid Transit Co. in its power house at Thirteenth and Mt. Vernon Streets, and Thirty-third and Market Sts. The steel work for the coal-handling scheme of the three houses was designed by A. Samuel Berquist, C. E., Brooklyn, N. Y., patentee of the Berquist bunker, and was erected by the American Bridge Company.

Below the whole line of boilers and passing through the base of the stack is a tunnel for the operation of the cinder cars. At the south end of the tunnel the cinders are discharged into a



View of Boilers at Wyoming Ave. Station During Erection.



General Plan and Cross Section of the New Station at Delaware Avenue and Laurel Street.

bucket elevator, by means of which they are taken up and dumped into the cinder bin. This is built over the trolley track to enable a car to be run under it and be loaded with the contents of the bin.

North of the station a double trestle is being erected for the storage of about 65,000 tons of coal. The tracks are 30 ft. apart. For supplying coal from this point to other stations, two trolley tracks at grade, or about 25 ft. below the trestle tracks, are being installed. Coal will be loaded on cars on these tracks from the trestle by a small locomotive crane with a clam-shell bucket. The piers supporting the trestle rest on Simplex concrete piles driven to rock.

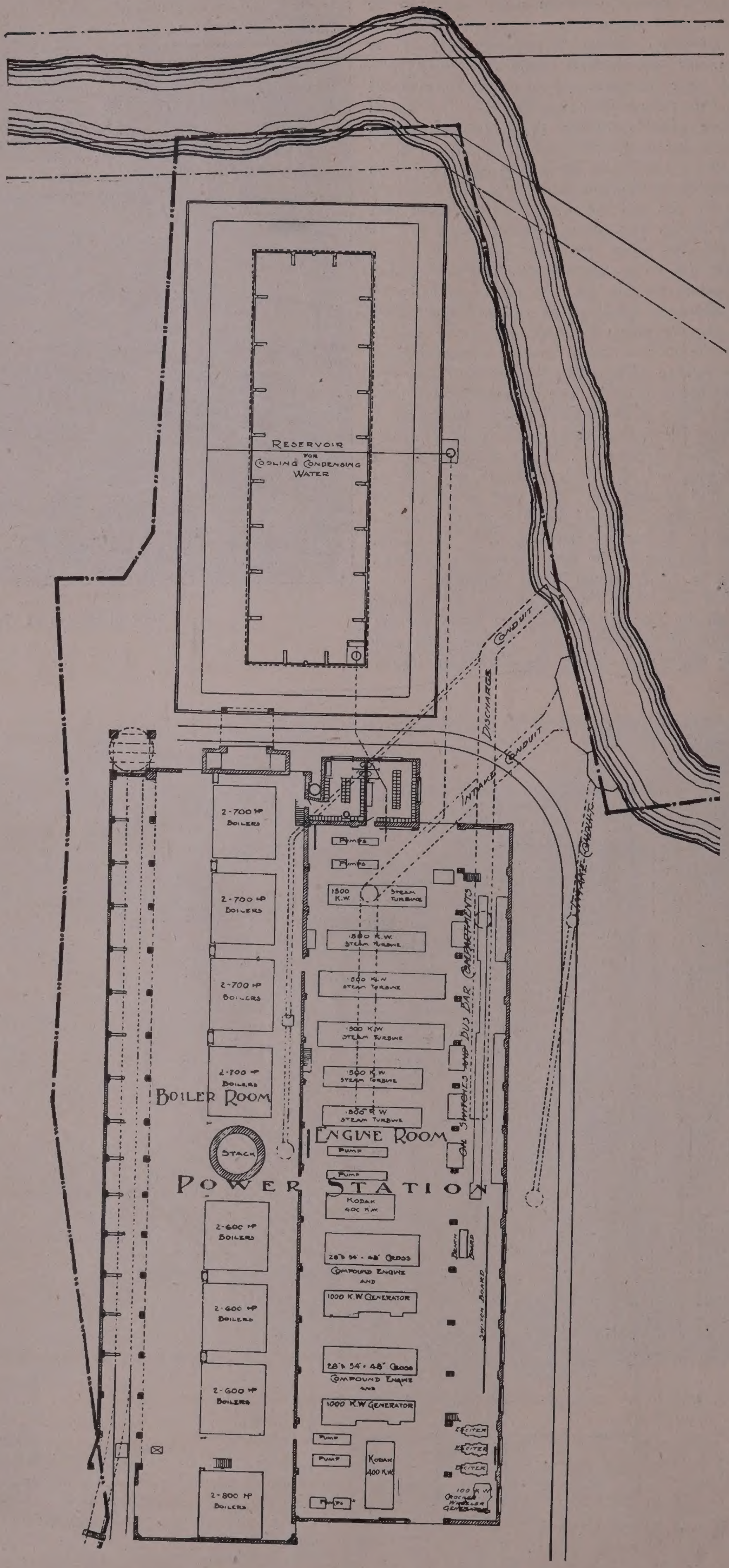
The cinders are discharged from below the boilers into cars, each having a capacity of about 1 cu. yd., which empty their contents into a bucket elevator, the bucket having the same capacity as a car. The elevators, driven by motors, convey the cinders to an overhead bin, elevated enough to allow the large car used for hauling coal and cinders to pass beneath it. The cinders are discharged from the bin into this car through cast-iron hoppers and are taken to some point for use in concrete work or in grading. The construction of these bins is entirely of concrete, reinforced with steel rods, the concrete withstanding the action of the cinders better than any other material. The walls are 5 or 6 in. thick, braced on the outside by vertical and horizontal beams, the bottom in some cases being inclined to facilitate the movement of the cinders toward the hoppers.

The station is rather remarkable for the amount of reinforced concrete work about it, not only in the columns and bin already referred to, but also for heavy girders in the boiler room and the floor of the engine room. The cooling reservoir for condensing water has walls of this material 11 ft. high, 8 in. thick and braced by buttresses on 16-ft. centers. The walls are banked with earth having a 30° slope. It might be added that the sewer in Wyoming Ave. near this station is also of reinforced concrete and rests on Simplex concrete piles.

Delaware Ave. Station.—The site of the new station at Delaware Ave. and Laurel St. is partially occupied by an old plant and the first section of the new station is being erected at one side of it. Upon the completion of this section the old plant will be torn down and the new building completed.

On account of the width of the property the arrangement in both boiler and engine rooms is very compact. The completed boiler room occupies a space 116 ft. wide and 340 ft. long. The arrangement of the boilers across the room divides it into a number of separate firing rooms, with the boilers face to face and back to back, there being 22 ft. between faces and 18 ft. between backs. For each turbine a line of boilers is planned, two in the center and three at each end, separated by narrow alleys. Each line has a separate stack, supported on the steelwork over the center pair of boilers. It was originally intended to have a coal bunker over each firing room. This would have almost entirely shut out the light and ventilation, and the design was accordingly changed, two bunkers being provided extending the entire length of the room over each of the outside batteries. Over the boilers the stack occupies the space between the bunkers, while over the firing room the space is occupied by a ventilating skylight, supplementing the light and air obtained from the windows on Delaware Ave. Along the fronts and backs of each line of boilers a gallery extends for the more convenient operation of the stokers.

The basement floor under the boiler room is 14 ft. below the main floor and under each line of boilers is a gallery, with the cinder chambers in the center. In the side walls of these chambers are doors, through which, from the gallery, a poke-bar can be run to loosen up the cinders. In the bottom of the cinder chambers are chutes,



General Plan of Station at Wyoming Avenue.

through which the cinders can be discharged into cars. Under each line of boilers is a track leading to a main track running the length of the basement, by which the cinder cars are taken to the elevators leading to the cinder bin.

The engine room occupies a space 78 ft. wide and 360 ft. long, with two galleries 17 ft. wide extending the entire length of the room. The plan contemplates the installation of eight turbine units, spaced 40 ft. center to center. In the space between the turbines will be located the exciters, etc. Under the gallery on the main floor will be the oil switch compartments. The first gallery will contain the switchboard. Over the main portion of the engine room is a three-motor traveling crane, 61 ft. span, with an auxiliary hoist. Over the oil switch compartments is a smaller traveling crane.

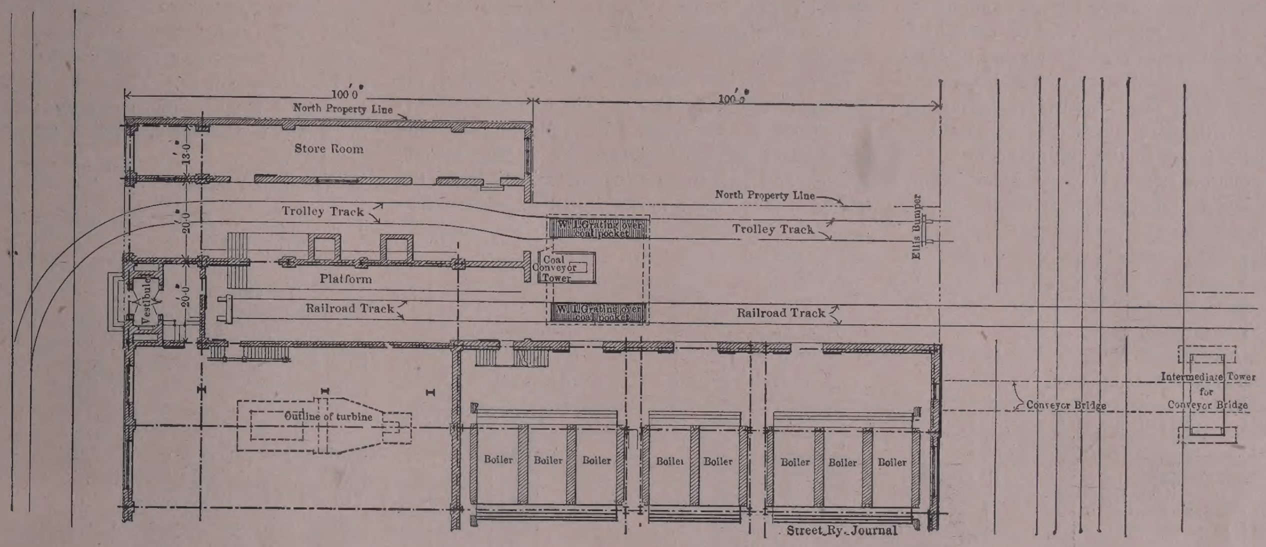
In the basement, the floor of which is 26 ft. below the main floor of the engine room, is located the condensing apparatus. A gallery, on which are located the bus-bar compartments, extends the entire length of the room.

At the north end of the engine room a spur track extends into the building, allowing machinery and materials to be unloaded by the overhead crane. Beyond this, on the ground level, is a small shop and storeroom; on the main floor, toilet and locker rooms, and on the floor above, the offices of the engineer, etc., adjacent to the entrance. Adjoining the toilet rooms and located over a trolley track is the cinder bin, to which the cinders are conveyed by the two bucket elevators previously mentioned, each bucket having the same capacity as the cinder car used in the basement. The cinders are discharged by chutes into a car, by which they are taken to a dump or to some point for use.

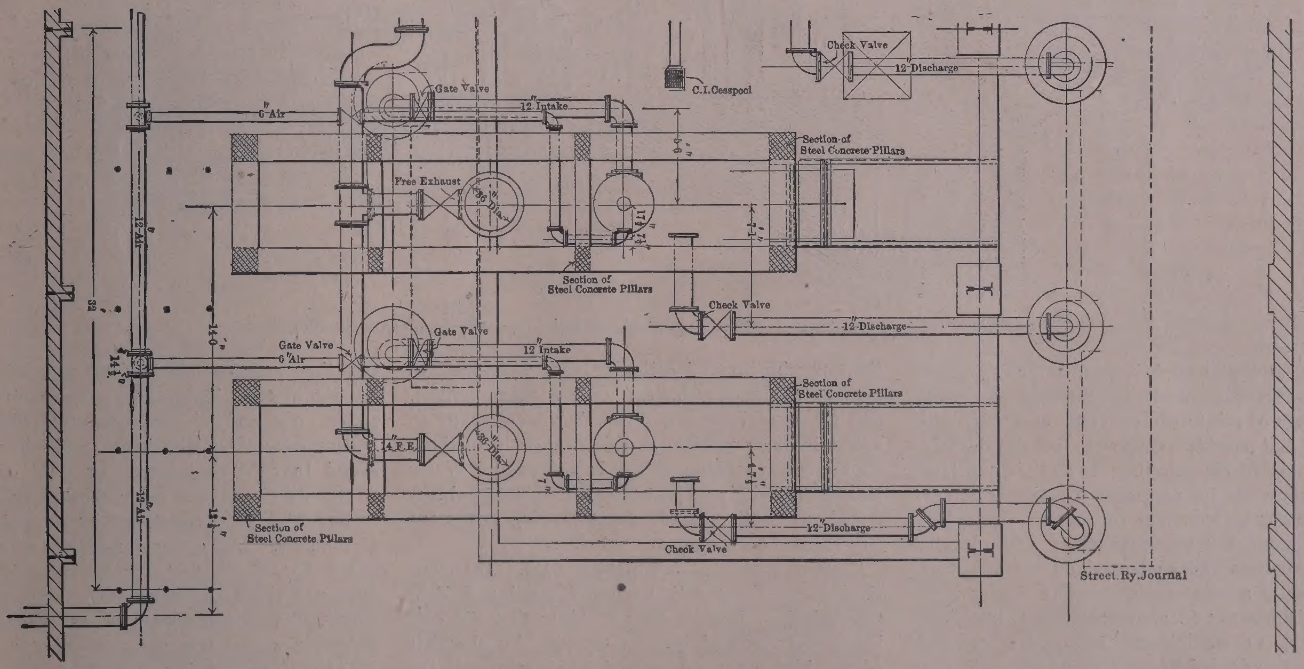
The cooling water for the condensing apparatus is conveyed by two conduits, each 63 sq. ft. in area, from the south side of the wharf, under Delaware Ave., under the basement floor and down the length of the engine room below the turbines, wells being constructed at the sides from which lead the pipes running to the condensers. At the entrance to the conduits are two screens of iron bars in channel frames, the second being somewhat closer spacing than the first, both of which can be raised by an overhead hand hoist for cleaning. Back of these screens is the intake chamber, and from this lead the two conduits, each having a heavy timber gate, one or both of which may be lowered, thus shutting off either conduit, so that it may be pumped out to allow any necessary repairs to be made. Should such a condition arise, water can be supplied through the other conduit, each of the two being of sufficient area to do the work alone.

The discharge conduit extends to the north side of the wharf.

On account of the character of the ground, the foundations presented an interesting problem, complicated by the location of the water conduits between the lines of columns. Below the upper stratum, which is a hard, coarse gravel, is a soft, black mud mixed with clay, extending down an average depth of 20 ft. to coarse sand. On account of these conditions it was decided to use piles for the foundations. Allowing a load of 20 tons per pile for wood piles, the heavy loads due to the coal bunkers and stacks made the areas of the footings such that it was found necessary to take the steel columns down below the bottom of the conduits, allowing the footings to spread out beneath them. As the bottom of these conduits is about 9 ft. below the basement floor level, and as water is encountered over the whole area



Plan of Coal and Ash Handling Equipment at Delaware Avenue Station.



Plan of Condensing Apparatus, Wyoming Avenue Station.

at a level about 2 ft. below the floor, thus making continual pumping and shoring necessary until the piles were driven and the columns erected, the objections to footings of this character can be readily understood. This led to the adoption of Raymond concrete piles, which, being spaced 30 in. center to center and sustaining a load per pile of 30 tons, made the areas of the footings about two-thirds the size necessary for wood piles, thus making it possible to construct the conduits between the footings, excavating below the basement floor only to the depth necessary for the concrete pile capping and the column bases.

The superstructure is supported on a skeleton steel construction, the columns having combination steel I-beam grillage and reinforced concrete footings, each column supported on an independent group of piles. The walls are of red brick with terra cotta cornice. The window frames are of metal glazed with wire glass. The main floor and the gallery floors in the engine room are of reinforced concrete slabs between steel beams. The entire boiler room floor, with the cinder chambers and gallery below and the piers and girders supporting the boiler columns and walls, are entirely of reinforced concrete, as are the coal bunkers and stacks. Concrete for the bunkers was considered cheaper than any other construction, because of its requiring practically no expenditure for maintenance or repairs.

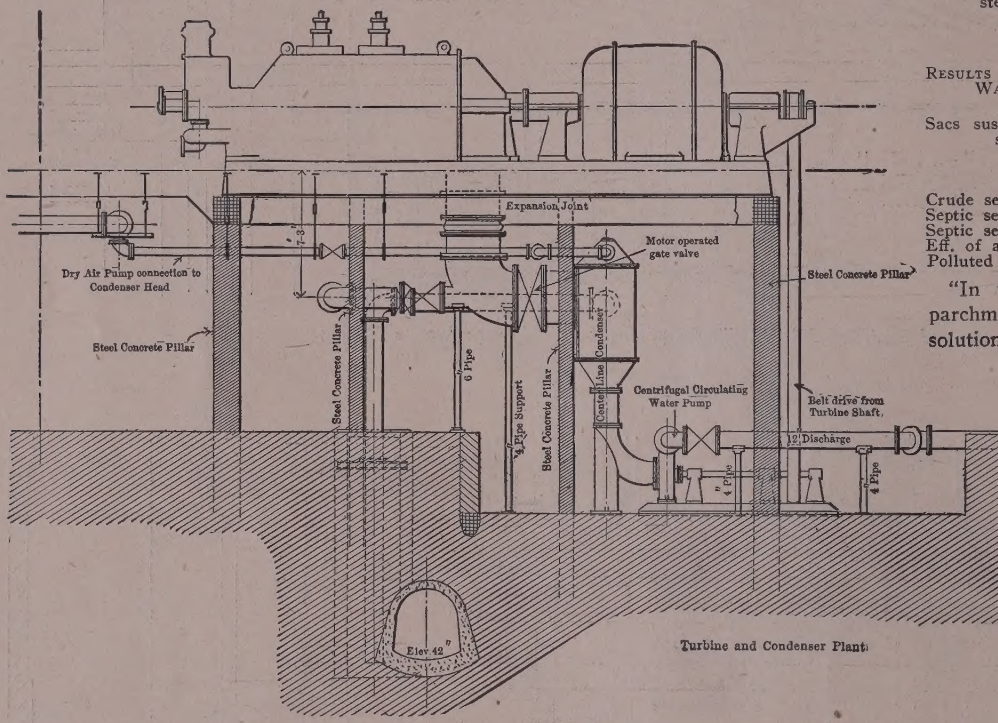
To economize space the stacks were located over the boilers and supported on the structural steel work at a point 50 ft. above the boiler room floor, finishing 175 ft. above this point, the diameter being 14 ft. inside. Reinforced concrete stacks were adopted because of economy in construction and maintenance and lightness, each stack weighing about 500 tons. They are supported on double-plate girders, between which are placed the anchor rods, the space between the girders and in the angles forming the circular base being filled with concrete.

The roofs are of cinder concrete slabs, reinforced with steel, supported on steel trusses, the top being finished with tar and gravel roofing. The ventilating skylights over the engine and boiler rooms are of copper glazed with wire glass.

Each line of boilers contains eight Parker boilers, with a normal rating of 800 h.p. each, equipped with superheaters. Automatic stokers will probably be installed. No economizers are contemplated.

The first three units to be installed in the engine room will be Westinghouse-Parsons turbines, each of 6,000 kw. capacity; the remaining five units will probably be 7,500 kw. each. Beyond this the character of the equipment at this writing has not as yet been definitely decided.

The compactness of the entire arrangement can be seen from the following data: Boiler room, 51,200 h.p., 39,440 sq. ft., or .77 sq. ft. per h.p. Engine room, 55,500 kw., 28,080 sq. ft., or .5 sq. ft. per kw.



Section Showing Condensing Plant and Turbine Supports, Wyoming Avenue Station.

Experiments with Typhoid Germs at the Columbus Testing Station.

Among the investigations recently made at the Sewage Testing Station at Columbus were experiments to determine the reliability of the methods followed by Messrs. Frost and Jordan, Russell and Zeit in certain determinations of the life of typhoid fever germs. In these determinations parchment and collodion sacs were used to contain the germs, instead of the usual bottles, and the experiments at Columbus were made to ascertain the propriety of this change in method. At the recent meeting of the New England Water Works Association, Mr. George A. Johnson, chemist of the Station, made the following important statements concerning this subject:

"These somewhat conflicting data, (the conclusions of Frost and Jordan, Russell and Zeit, respectively), suggest the possibility that the collodion sacs offered less opportunity for the exit of the highly motile typhoid bacilli through the walls of the sacs, than did the sacs of parchment. If this was not so the thought presents itself that possibly after several days of service the initial integrity of the parchment sacs was impaired to an extent sufficient to permit of the escape therefrom of the typhoid bacilli. To place the results of studies of this character upon a perfectly sound basis, positive data and statements are required to show whether the initial bacterial integrity of the sacs containing the typhoid bacilli continued unimpaired throughout the experiment.

"Such definite information as referred to is called for, in the opinion of the writer, for the reason that studies in this line at the Columbus Sewage Testing Station have shown that in some instances parchment sacs, possessing initially and retaining throughout the experiments perfect integrity so far as their dialyzing properties were concerned, permitted the escape therefrom of B. coli when immersed in distilled water; and, further, similar sacs containing sterilized water, when submerged in flowing streams of sewage and polluted water, permitted the entrance in a comparatively short time of large numbers of bacteria, including B. coli. Typhoid bacilli were not studied in this connection, but the conclusion may be justly drawn, in view of the highly motile character of the typhoid bacillus, that if other less motile forms could pass through the walls of the parchment sacs under such conditions, there is no room for reasonable doubt regarding the ability of typhoid bacilli to act in a similar manner. The results of the Columbus studies referred to are presented in the accompanying tables:

Results Illustrative of Escape of B. coli Through Walls of Parchment Sacs Immersed in Sterilized Water.

Time sacs were suspended in sterilized water.	B. coli per C. C. in water surrounding sacs.		
	Sac A	Sac B	Sac C
0 hours	0	0	0
24 hours	Over 1,000	Over 1,000	Over 1,000

Results Illustrative of Passage of B. coli Through Walls of Parchment Sacs from Outside.

Sacs suspended in flowing stream of	B. coli per C. C. in water contained in sacs. Number of hours sacs were exposed in current		
	0	48	72
Crude sewage	0	320	2,000
Septic sewage	0	320	2,000
Septic sewage	0	120	1,100
Eff. of a sewage filter	0	400	2,000
Polluted water	0	0	40

"In the first series of the experiments the parchment sacs were filled with a 5 per cent. solution of starch, both ends tightly tied, and the sacs then immersed in half-gallon bottles containing tap water. These bottles were plugged with cotton, one end of the sacs protruding. These bottles were then autoclaved, and after being allowed to cool the protruding ends of the sacs were opened and one cubic centimeter of a broth culture of B. coli communis introduced into each of the sacs. The water outside the sacs was then tested for starch and for B. coli. The results were negative in all cases. The bottles were then permitted to stand for 24 hours, when the water outside the sacs was again tested for starch and B. coli. The starch test gave a negative result in all cases. B. coli were found in large numbers in all cases, as shown in the table.

"In the second series of experiments the sacs were filled with tap water, sterilized, and tested for sterility, which was found to be perfect in all cases. The sacs were then suspended in flowing streams of sewage and polluted water, the contents being tested at intervals for bacteria. Inside 48 hours bacteria appeared in the sacs, as shown in the tables. The dialyzing properties of all the sacs were carefully tested at the beginning and at the end of this, as well as in the case of the other series of experiments, and were found to be unimpaired in all cases."

Settlement of Chicago Buildings Due to Tunneling.

In response to a request from the Commissioner of Public Works, of Chicago, Messrs. John M. Ewen, E. C. Shankland and L. E. Ritter have supplemented their first report on the results of tunneling under the streets (see Eng. Record Aug. 26) with a detailed statement of places where settlement of streets and buildings can be properly attributed to this work. In the first report they stated that they could find no damage due to settlement of streets or buildings where the work was confined to the main line tunnels. It was not until the greater portion of the tunnels was finished in the down-town district and the work of making connections to buildings was attempted that settlements were noticed. The main tunnel, as constructed in each case, below the middle of the street, fell outside the lines of pressure from the buildings on either side. It was only necessary to consider the load from the clay above; but, in the case of the by-passes and connection to buildings, it is apparent that the excavation would be in clay that was under pressure from the weight of these buildings, as well as under pressure from the weight of the clay above. The larger portion of this work has been executed under air pressure of about eight or ten pounds, which pressure has aided materially in preventing settlement of the streets. A small portion of this work has been executed without air pressure without any apparent settlement of the streets, but as the risk in doing the work without air pressure was greater, apparatus and men were constantly kept in attendance to stop any caving-in that might occur.

When it became necessary to build by-passes and connections to buildings, soil under great compression had to be cut into and the conditions encountered grew more serious in exact proportion as the work came nearer to this soil under greater compression, and the whole engineering proposition became more difficult. It has been, from the commencement of the investigation, very apparent to the commission that this condition of affairs has not been fully realized by those in charge of the work, for without materially changing the method of operation, connections have been attempted at several places, with the result that settlements and damage to streets and buildings have taken place. The commission gives the following instances: The settlement at the intersection of State St. and Jackson Boulevard, that of the northwest corner of the Pullman building at the corner of Adams St. and Michigan Ave.; that of Adams St. in front of the Republic building, that of the southwest corner of Marshall Field's wholesale store at the corner of Franklin and Quincy Sts. At all of these places the fact that settlements have taken place has been apparent to the eye and needs no further verification.

The facts that led the commission to the conclusion that these settlements were due to the tunnel operations are as follows:

The sinking at the intersection of State St. and Jackson Boulevard was caused when the turn-out curves at the intersection of the tunnels were constructed. In making the excavations for these curves, the face of the clay that was uncovered was too great to allow of its self-support, and the movement of the clay before a new support could be supplied caused the settlement of the street surface of about 9 in. The telephone company driving the tunnels admitted that this was due to carelessness on the part of the employees in attempting to do too much of the work at one time.

The settlement of the sidewalk and corner pier of the Pullman building, the commission believes, was due to the fact that too great a surface of the clay in the tunnel was exposed at one time, so that the movement in the clay was transmitted to the foundations of the building and settlement occurred. This connection was continued under the alley for a distance of about 50 ft. from the center of Adams St. and is now bulkheaded up, and no further work is being done.

A decided settlement of the street of between 1 and 2 ft. at the north side of the Republic building, corner of State and Adams Sts., took place during the construction of this building. The tunnel company took the contract to remove the clay from the excavation of the building, and they started to build a connection to be used for this purpose temporarily and afterwards to be made into a permanent connection to the building. Before this connection was provided the settlement occurred and the connection was bulkheaded and abandoned, and the tunnel company removed the clay by wagons.

The settlement of the Marshall Field wholesale store at the corner of Franklin and Quincy Sts., occurred suddenly on May 25, and cracked the stone work from the street level to the top of the building, some of the cracks being from 4 to 6 in. in width. As the statement has been made several times that this settlement was due to the building of the caisson foundations of the Chicago & Northwestern R. R. Company's new office building, which stands directly opposite on Quincy St., the commission deems it proper to give a brief history of the case.

The caisson foundations of the Northwestern building were completed on June 19, 1904, and all of the steel work of the building was completed on Nov. 3 of that year. Before the foundation work was started, bench marks were established on all the buildings surrounding the Northwestern building, including points in the Field building. Levels were taken at frequent intervals during the construction of the building, and at the end of December, 1904, about two months after completion of its erection and when all settlements of surrounding buildings had ceased, it was shown that no damage was done to the Field Building excepting a slight crack in one window sill. This crack was noticed in the summer, and its condition was unchanged when levels were taken in December.

On May 25, 1905, when the sudden settlement of the Field building occurred, another set of levels was taken on that building and continued throughout the summer, the last being taken Sept. 1, showing a settlement during this time of 3⅛ in. Mr. W. R. Northway, assistant city engineer, in a report to the commission on July 27, 1905, concerning this matter, stated that this connection was started on May 11, 1905, and "the last mining was done the night of May 24 and both ends connected and bulkheaded May 25, 1905."

The curb wall of the Chicago & Northwestern office building in Quincy St. cracked horizontally on the same date, May 25. This crack begins at Franklin St. and extends east 35 to 40 ft. All the above is conclusive proof, the committee contends, that the damage to the Field building was due to the tunnel operation at the time and not to the operations on the foundations of the Northwestern building, which took place one year previous.

The tunnel company has permits to connect with many buildings in the down-town district, but so far has only completed four connections, in addition to the connections to its own buildings. The connection to the Heyworth building is a curve of the tunnel leading into the deep basement of that building on the same level as the tunnel. The Heyworth building stands on caisson foundations. Another connection has been completed into the basement of the Majestic Theatre building on Monroe St., consisting of a by-pass, tangent to the curb wall on the tunnel level, and the vertical shaft reaching from this by-pass to the basement of the building. This building also stands on caisson foundations. Another connnection is being made to Marshall Field's retail store on State St. similar in character to that in the Heyworth building. This building also stands on caisson foundations. The fourth is to Mandel Brothers' building on Wabash Ave., which is also on caisson foundations. A number of temporary chutes have been built connecting the tunnel with buildings now in course of erection. These chutes lead at an angle from the basements of the buildings to the roof of the tunnel and are used for conveying the clay excavated to the lake front. No other connections, so far as the commission could ascertain, have been made.

There is no reason why they should not be put in, provided a scheme is developed to meet the conditions peculiar to each case. It is not feasible to make a plan that can be safely followed for all connections. It is manifest that the least complicated cases will occur when the building to be connected stands on caisson foundations. Even then damage may be expected to adjacent buildings that stand on spread foundations, and consequently streets in front of these buildings might be affected. Buildings resting on pile foundations may be, in most cases, classed with buildings resting on caisson foundations.

The cases where old buildings have been erected on spread foundations, which do not extend to the blue clay, would probably present a great many difficulties, and a plan carefully studied out would have to be made to meet each case. The most difficult and dangerous cases to handle will be those of the high heavy buildings resting upon spread foundations. Connections to them will require the utmost care in both planning and execution.

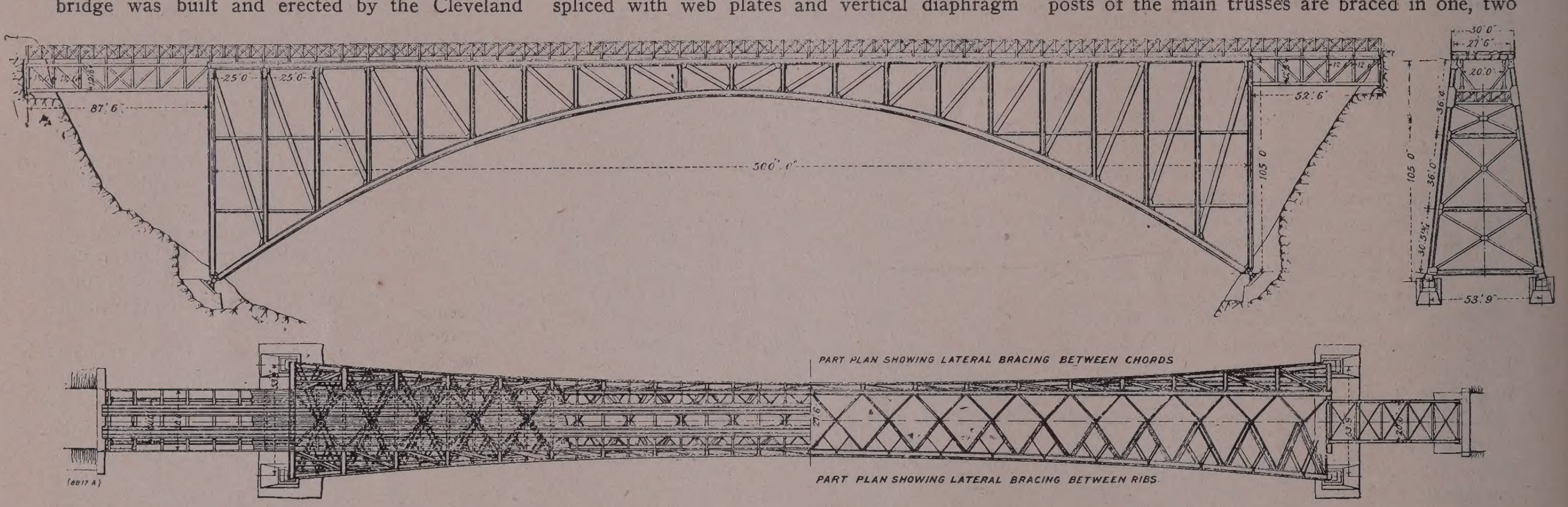
The commission has believed from the commencement of its investigation that the problem of making these connections to the tunnels is one that will tax all the ingenuity and skill of the engineer, and is of greater importance from an engineering point of view than the construction of the tunnels themselves. It should be treated with the greatest care by both the tunnel company and the city before the work is prosecuted. A comprehensive scheme should first be agreed upon and proper steps taken to see that it is rigidly carried out. Even then there will probably be some settlement, but it can be reduced to a minimum.

In the commission's opinion it is not practicable to work under air pressure in making the connections, neither does it believe the air pressure would be sufficient to sustain the pressure of the foundations on the soil. The soil must be held by mechanical means in some such way as the caissons or wells are sunk to form the foundations of heavy buildings. It is a building proposition, and the methods common in building practice will probably meet all the difficulties that may be encountered. The connection should be circular in section rather than elliptical, and the lagging should be put in with the greatest skill possible.

THE WATER POWER DEVELOPMENT at the Willimantic Mills of the American Thread Co. is remarkable for the fact that the intakes to the wheels are from three different dams about 500 ft. apart. The canal from the first dam feeds an 800-h.-p. horizontal turbine, which discharges its water into the pond of the second dam. This pond feeds three 250-h.-p. vertical turbines, which discharge into the pond of the third dam. This pond furnishes water to two 75-h.-p. vertical turbines. The average total available water power is 1,100-h.-p., a little more than a third of that required to run the mills.

The Zambesi River Bridge, Victoria Falls, Rhodesia.

The Zambesi River bridge at Victoria Falls, Rhodesia, illustrated in this journal on Aug. 26, was formally opened on Sept. 12 in the presence of the members of the British Association. Prof. Geo. H. Darwin, president of the association, made the opening address and commented happily on the engineering achievements which permitted a large party traveling in luxurious electrically lighted parlor cars to visit a place which, not many years ago, explorers had spent months of fruitless endeavor to reach. The Rhodesia Ry., of which this structure is an important feature, was fully described in recent issues of this journal. The bridge is about half a mile below the falls and 400 ft. above the rapids at a point where the gorge is about 650 ft. wide at the top, with precipitous cliffs of hard basalt. From a detailed account of the structure in "Engineering," it appears that the bridge is 650 ft. long, weighs 1,650 tons and has cost about $350,000, including erection. It consists of a two-hinged, riveted arch span of 500 ft., and short lattice girder spans in the approaches. The design was one of several prepared by Mr. G. A. Hobson, and the bridge was built and erected by the Cleveland Bridge and Engineering Co., Darlington, England.


25'0"
25'0"
87'6"
500'0"
105'0"
52'6"
30'0"
27'6"
20'0"
36'4"
36'0"
105'0"
30'3¼"
53'9"
PART PLAN SHOWING LATERAL BRACING BETWEEN CHORDS
PART PLAN SHOWING LATERAL BRACING BETWEEN RIBS
(8817 A)

Side Elevation, End Vertical Bent and Half Plans of Zambesi Bridge.

The arch trusses have a rise of 90 ft., a depth of 105 ft. at skewbacks and 15 ft. at crown, are battered 1:8 and are 27 ft. 6 in. apart on centers at the crown and 53 ft. 9 in. apart at the skewbacks. All members and all connections are riveted. The bridge is proportioned for a live load of two locomotives followed by a train weighing 2.8 tons per linear foot on each track, for a wind pressure of 45 lb. per square foot on the entire area of both trusses, or for 30 lb. per square foot of both train and bridge surface, and for temperature stresses caused by a total variation of 120° Fahr. The arch was designed with two hinges on account of the greater rigidity and economy of material.

The principal arch members are made with two built channels in vertical planes, latticed. Care is taken to avoid all box sections or other forms which might collect water. The struts are, in most cases, made with a T-shape cross section, the flanges usually being made with a pair of angles, back to back, or in the lighter members, with T-bar flanges and lattice webs. The lower chord is the principal truss member, and is made in lengths of slightly more than 25 ft. with the ends accurately faced to make the directions correspond with chords of a parabola. It is 36 in. deep and 34 in. wide, and is made throughout with 1-in. web plates and 6x6x1-in. flange angles, reinforced by side plates of different thicknesses to make the varying cross sections. The channels are latticed on both flanges with transverse and zigzag angles and at each end and in the center have narrow tie plates, the center ones projecting to form bent jaw plates receiving the lateral diagonals. The tie plates are also riveted to vertical transverse diaphragms, and horizontal diaphragms are introduced at the joints, which are made at the center of the panel points, and are spliced with web cover plates, and with narrow flange cover plates.

The top chord is similar to the bottom chord, except that it is lighter and that the splices are made about 4½ ft. beyond the panel points. It is 32 in. wide and 30 in. deep over all, and is made with 1-in. web plates reinforced by ⅝-in. side plates. Vertical transverse diaphragms are provided at the floorbeam connections and at the splices, and the latter are riveted to horizontal diaphragms, together making T-shape reinforcements. The vertical posts are made with a pair of built channels latticed with small angles, which have, like the chords, a transverse angle between each two inclined angles. At the ends they are shop-riveted to jaw plates engaging the diagonal members, and the webs of the top and bottom chords to which they are field-riveted. At the intersection with the horizontal struts they are spliced with web plates and vertical diaphragm parallel to the bridge axis. The diagonals are of similar construction to the verticals, and their web plates are continued beyond the ends of the flange angles for the connections with the jaw plates on the posts. The channels are latticed together with their flanges turned inwards to afford clearance with the chords.

The trusses are braced together by the floor system, top and bottom lateral systems and by the sway braces. The floor system consists of a solid full width deck supported on the top chords by 30-in. plate girder floorbeams at the panel points and at the centers of the panels, the top chords acting as girders between panel points. The lower flanges of the floorbeams are beveled upwards, 1:8 at the ends to correspond with the batter of the trusses and are seated on the top flanges of the top chords of the arch trusses. The track stringers are seated across the top flanges of the floorbeams and each consists of a pair of 12-in. channels 13 in. apart, back to back. The channels are knee braced to each floorbeam by bent T-bars and continuous horizontal shelf angles are riveted to the lower edges of their webs and support a 12x5½-in. wooden sleeper to which the rails are bolted. A ¼-in. horizontal floorplate connects the inner top flanges of the channels of each track and forms a solid covering between the rails. The space between and outside the tracks is decked solid with 9x3-in. planks 25 ft. long with lap joints, which are supported on the floorbeams and on intermediate transverse T-bars 6 ft. 3 in. apart. The planks are secured with countersunk bolts, creosoted and covered with tar and gravel. The deck is protected by heavy hand rails made with 8-in. vertical channels riveted across the ends of the floorbeam webs and connected by trusses made with a 5x3-in. T-bar for top chord and a 12-in. web plate and a pair of flange angles for the T-shape bottom chord. The panels are X-braced and covered with expanded metal of 6-in. mesh.

The top lateral system is made with transverse struts between the top chords at panel points and X-bracing in all panels. All the members are I-shape, made with two pairs of angles, back to back, latticed and are of the same depth as the top chords and are connected to the flanges of the latter by jaw plates. In each panel one diagonal is continuous, and the other is cut to clear it and spliced across it with flange cover plates. The bottom, lateral bracing is in the planes of the lower chords and corresponds with the top lateral system except that on account of the greater length of the diagonals they are are braced half way between the end and the intersction with a sub-diagonal strut to the bottom chord at the center of the panel. The vertical posts of the main trusses are braced in one, two or three panels, according to length, by horizontal struts made with rectangular cross sections made with four light angles, latticed, and with X-braces of I-shape cross sections made with two T-bars latticed. Horizontal struts, made with a pair of 12-in. channels, latticed, connect the long vertical posts in the arch trusses and are riveted to the diagonal members of the arch trusses where the latter pass through them between their channel webs. At these points the struts are also stiffened laterally by kneebraces made with pairs of T-bars, latticed, which extend to the transverse swaybrace struts.

The end of the end section of lower chord and the foot of the end vertical post are made square with a transverse diaphragm or base plate at right angles to the axis of the piece. These base plates are seated on a 1¼-in. thick bent plate supported by two heavy forged webs, transverse to the bridge axis, one 2 ft. high and 2½ in. thick is in the plane of the vertical web end posts and the other 4½-in. thick, is in the plane of the bottom chords. These webs have an I-shape cross section and are connected together by two riveted longitudinal diaphragms in the plane of the arch truss. The lower flanges of the transverse webs have bearing, and are tap-bolted to the oblique faces of a forged steel saddle piece with a half hole bearing on the upper side of the 12-in. skewback pin, nearly 6 ft. long, which has a 3-in. hole through the axis and is proportioned to transmit the 1,600-ton load with a pressure of 2½ tons per square inch. The pin rests in a semi-cylindrical steel forged bearing 2 in. thick, which is supported and countersunk riveted to a pedestal with six longitudinal riveted steel webs 1 in. thick. Normal to the base plate 10-in. channels are riveted to the pedestal webs, forming a transverse diaphragm connecting them in the plane of the arch thrust. These channels are in pairs, back to back, and are bent at the top to the radius of the pin bearing so as to form a socket to receive the latter.

The 5 ft. 7 in. x 5 ft. 8 in. base plate 1-in. thick, is seated on a bolster made of seven deep I-beams with top and bottom planed flange cover plates 1-in. thick. This is seated, at an angle of 45 degrees with the horizontal, on the concrete abutment to which it transmits a maximum pressure of 20 tons per square ft. The lower ends of the bolster beams are beveled and have a cover plate fitting a horizontal masonry seat provided for convenience in setting. In erection the bolster was adjusted accurately with wedges and grouted in position, and the interstices between the I-beam webs were filled with grout or concrete. The pedestal was adjusted to the bolster by eight 1½-in. bolts with slotted holes in the base plate.

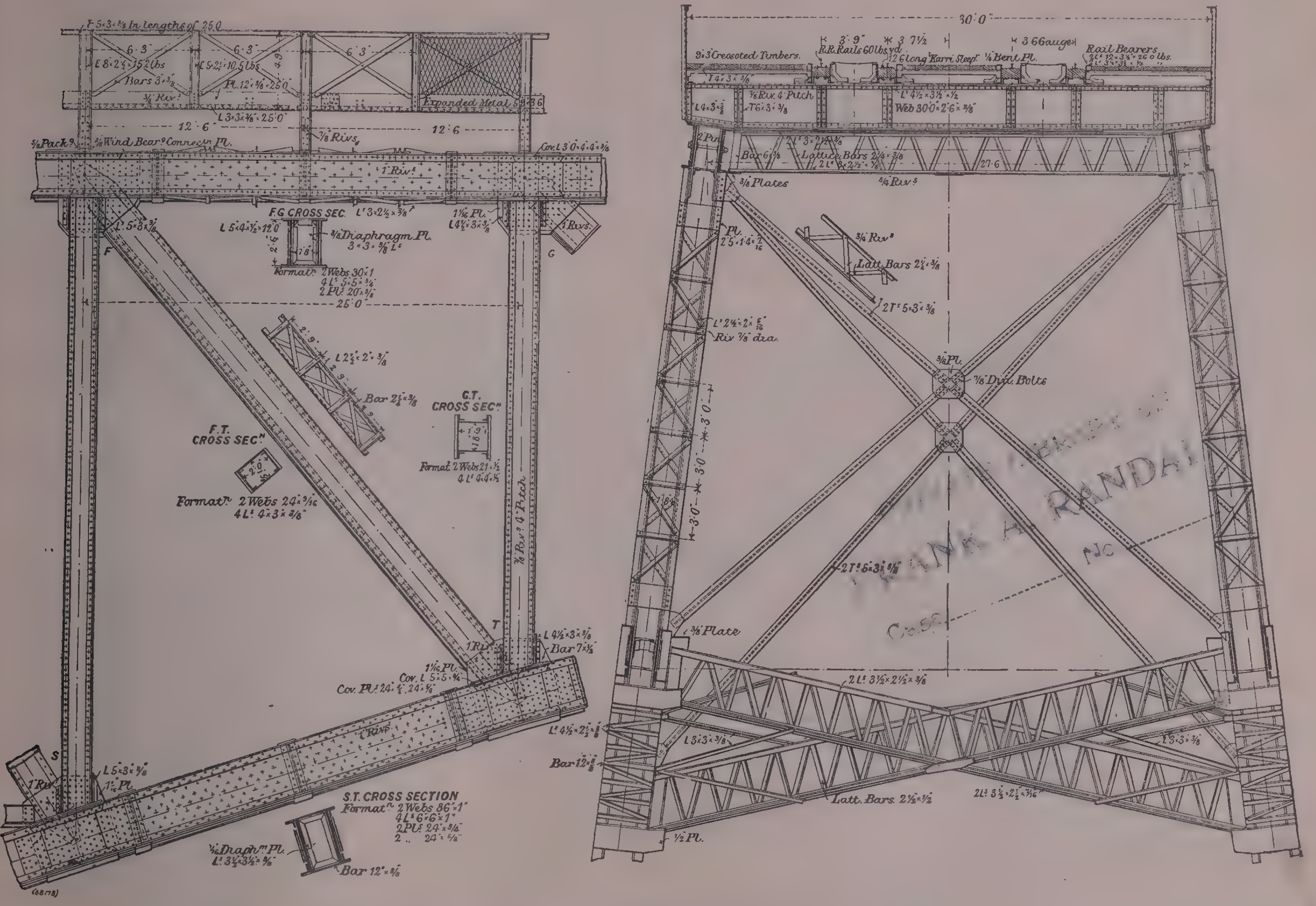
In order to insure accuracy and avoid the necessity of fitting in the field the bridge was completely assembled in sections at the bridge shops in England. The end panels of the arch trusses were assembled separately in horizontal planes on blocking in the yard, then the second and third panels, and the fourth, fifth and sixth panels were similarly assembled, and after they had been taken apart their top and bottom chords were assembled again in parallel horizontal lines so as to allow the lateral systems to be assembled to them. Finally the eight central panels of both trusses were erected together in reversed position; i. e., with the horizontal top chords on the ground, and all the lateral and sway bracing was fitted. All the joints in the trusses are completely riveted, but in order to facilitate erection each of them was also provided with a pin connection designed to be as light as possible and be efficient to sustain one panel as erected. The pins were 2 in. in diameter, and were provided with pipe separators or sleeves, and with pilot nuts. Their use was considered very advantageous in the field.

The steelwork was all delivered by the railroad at one end of the bridge and half of it was carried across to the opposite bank of the river by a cableway with a capacity of 200 tons per diem, which was installed by the contractors so as to provide also for the advance transmission of railroad supplies across the chasm, enabling the line to be extended a considerable distance before the completion of the bridge.

The contract for the cableway was awarded in July, 1903. It was built at Darlington, England, arrived at the bridge site in June, 1904, and was erected and in operation July 28. It is of special design, made with a steel rope 8½ in. in circumference, with a hemp core and six strands of nineteen 0.125-in. wires. It had a total length of 870 ft., a breaking strength of 275 tons, and weighs 5 tons. At one end it had a fixed anchorage to concrete blocks, and was supported on a steel tower 36 ft. high. The other end was connected to the top of a pair of 80 ft. shear legs, hinged at the bottom. A heavy counterweight was suspended from the top of the shear legs and rose and fell as the loaded trolley moved along the cable. The trolley weighed 5 tons, and had a capacity of 10 tons. The trolley frame was suspended from two traveler wheels and carried an electric motor, two hoisting drums and an operator's chair.

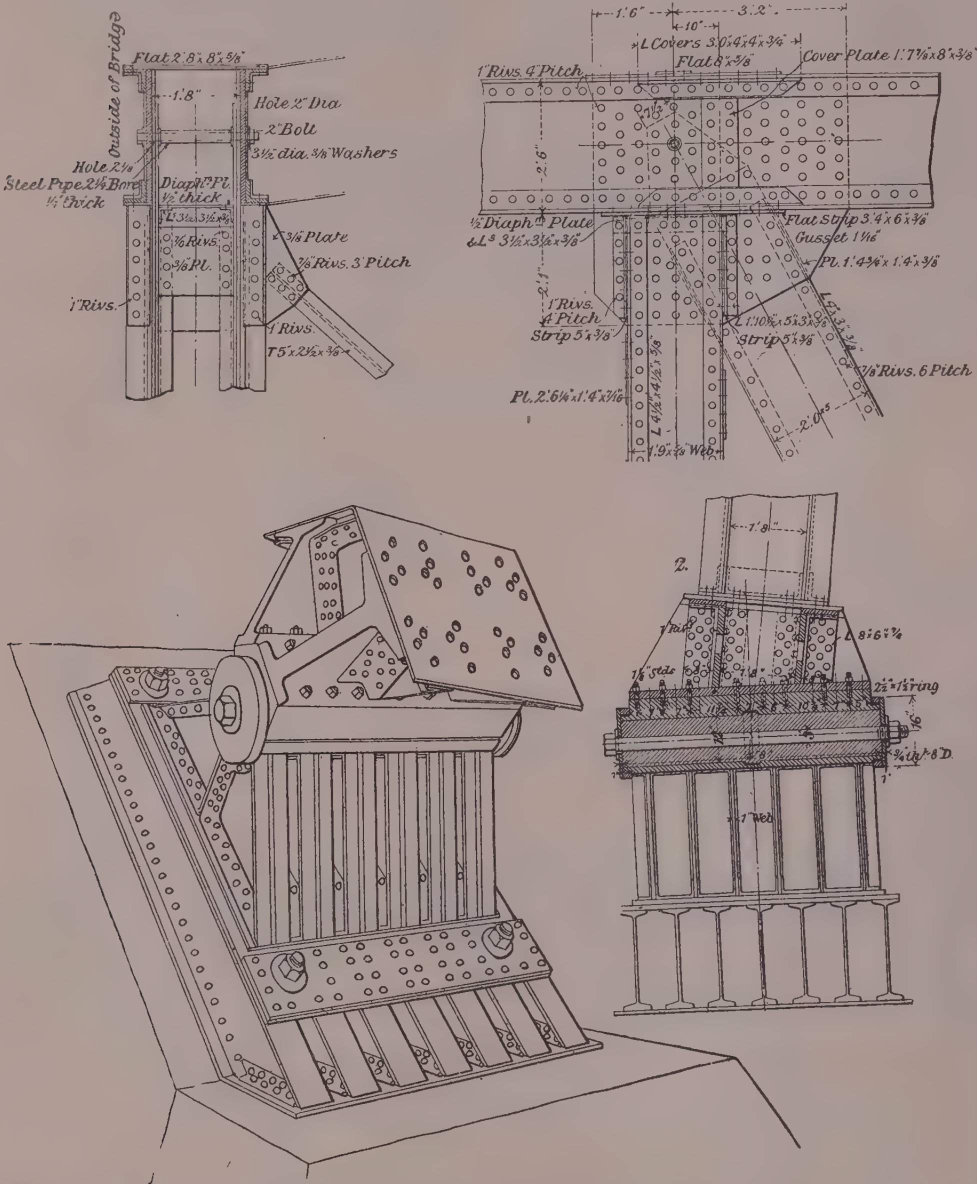
After being some time in service, considerable wear was noticed on the first trolley and a second one was built at a cost of about $2,000, so as to be ready for use without delay in case of emergency. It differed slightly from the first one in that wrought instead of cast steel was used for bed plates and fittings, harder detachable tires were substituted for the original ones, which wore out rapidly on the travel wheels, and the hoisting mechanism was operated by spur instead of by worm gears. Toward the end of the work it was discovered that about 13 per cent. of the wires in the main cable were broken, and the loads were immediately diminished, and a new cable was ordered, but it is not stated that either the new cable or the new trolley were actually put in service. In erecting the cable a cord was shot across the chasm attached to a rocket, a wire was hauled across by the cord and the latter in turn pulled over a small rope on which a steel carrier was fitted and hauled across by a windlass and carried the end of the main cables.

The first construction work was, of course, the building of the concrete abutments and skew-back piers which were commenced in May, 1904, and finished in October. They were substantially frustrums of rectangular pyramids with their sides battered 1:2 and 1:4 and their bases parallel with the bed plates of the pedestals and bolsters except that extensions were made on the river sides to provide for the horizontal parts of the



Intermediate Panels of Arch Truss, Sway Bracing and Lower Lateral System.

bolster bearings. They were built in pits excavated a few feet to the surface of the solid rock, which was dressed approximately parallel with the bearing surfaces of the bolster and was covered with concrete in which reinforcement rails were bedded. The concrete was made 1:2:3, with cement shipped in sealed iron cases, and was reinforced in the upper part with a horizontal layer of ¾-in. iron rods with the ends bent at right angles to form a bond. A grillage of 6-in. steel I-beams was bedded in the concrete just below the bearing for the bolster and the latter was secured by 3-in. foundation bolts set in 4½-in. sleeves, which allowed for adjustment, after which they were sealed with grout.



Top Chord Panel Point and Skewback Bearing.

The semi-arch trusses were erected as cantilevers secured by anchorages attached to temporary 7-in. pins 6 ft. long through the ends of the top chords and tops of the end posts. Four small shafts, inclined about 45 degrees from the vertical, were excavated in vertical planes through the top chords in the solid rock some distance beyond the shore ends of the approach spans. These shafts were located symmetrically with each other and the bridge axis and the feet of each pair on the same side of the river were connected by a small horizontal tunnel. Steel wire ropes, with an ultimate strength of 200,000 lb. per square inch were passed down one shaft, through the tunnel and out of the other shaft, and their ends were socketed into bearing blocks through which were passed the ends of 2-in. U-bars with nuts engaging the socket, and the loop engaging the 7-in. pin in the end of the arch truss top chord. By this arrangement the span was anchored to a large mass of solid, undisturbed rock, utilizing not only its weight but the shearing strength of large surfaces which afforded a resistance still farther increased by piling 400 tons of rails on the surface between the shafts.

The arch trusses were erected in the usual cantilever manner simultaneously from both shores, by simple travelers, which moved on the finished floor platforms of the bridge. Each traveler had a horizontal timber platform about 30 ft. wide and 38 ft. long, supporting on the front corners two 10-ton, 30-ft. boom derricks with their masts braced together and having longitudinal stiff legs to the rear corners of the platform. The travelers commenced the erection of the approach spans on Oct. 21, 1904, by the cantilever method, the shore ends being supported on the abutments and trestle bents and anchored at the tops of the end vertical posts. Falsework trestles were built a few feet from the skewbacks, on the shore sides, and the river ends of the spans were landed on them and the travelers moved out to the ends and commenced the erection of the arch trusses.

As soon as the end posts were assembled and anchored the river ends of the approach spans were permanently seated on cross girders on them and the trestles were removed. The skewbacks were set by Oct. 20, and the center panel connection was made April 1, 1905. The first panels being the largest and the workmen being less experienced and confident, from two to three weeks each were required for their erection; this time was gradually reduced until at the center of the span eight panels were erected in 26 days. A net under the bridge was provided to catch tools or workmen who might fall, but instead of inspiring confidence in the workmen, was considered to make them nervous. The center top chord joint was designed to have an opening of 8 in. when erected, so as to allow an adjustment by hydraulic jacks, which were operated there to produce the exact computed stress, equivalent to 152 tons at 70° Fah. Packing pieces were planed to exactly fit the opening and were inserted and cover splice plates were drilled to fit and riveted on, changing the arch from a temporarily three-hinge structure to a permanent two-hinge structure. Power for all hoisting, lighting and cableway operation was furnished by an electric plant installed for the purpose. The cost of the steel work in England was about $100,000.

Moving Gas Holder Tanks.

The San Francisco Gas Co. recently had need of oil storage at its Potrero station and it accordingly decided to move for the purpose from its Equitable works the lower tanks of a couple of gas holders no longer used. These were 72½ ft. in diameter and 25 ft. high, and the plates were thick enough to enable the sides to be raised 12 ft. more, giving each tank 25,000 bbl. capacity. After considerable difficulty the company persuaded the contracting firms of Blume & Cramm to undertake to move them across the bay on barges.

After taking out the two lifts, the top, and taking down the frame, poles were erected on the inside over the points where the stringers, which were to be used in lifting the tank, were to be placed. From these poles wires were run to the outside edge of the tank and the tank trussed, as it were, so that there would be no bending of the bottom, and so that the side would not get out of place. The tanks were then wedged up as high as convenient and then jacked to about 5 ft. above ground. Under these were placed the ordinary timbers used by house movers and rollers. The tanks were then skidded out to the edge of the wharf, which had been braced to carry them, and a barge pulled alongside at high tide, and the tank was moved out to the barge. Meantime the tide went down and left one corner of the barge supporting the outer corner of the tank—the other side of the tank remaining on the wharf—the tank, however, being shifted far enough ahead to be in a permanent position on the barge. When the tide came up the barge lifted the tank clear of the wharf and was towed out to stream. The method of taking the tank off at Potrero wharf was similar to loading, the barge being hauled at high tide to a concrete and stone bulkhead, and the tank was hauled off the barge on the second tide after it had arrived there. The matter of moving tanks to the foundation was a simple proposition.

The Columbus Sewage Works will have the first large installation of sprinkling filters in this country. The provisional plans for works, made some years ago, called for intermittent filters, which would have been very expensive. The experiments at the Columbus Experiment Station have shown, however, that septic tanks and sprinkling filters will answer all the requirements, and save very large sums. The tanks will be 12 ft. deep and of 8,000,000 gal. capacity, and there will be 10 acres of filters.

Public Engineering Work in the Philippines.

The appearance of the fifth annual report of the Philippine Commission enables a general idea to be formed of the character of the public engineering works in the Islands down to November 1 of last year. The situation is a peculiar one and brings out clearly the valuable pioneering work of the engineer in advancing civilization as well as in increasing the comforts of urban life. The great bulk of the civilized Filipinos live on or near the coast line, but there are scattered communities living in the mountains who come little in touch with civilizing influences, are densely ignorant and superstitious, and are in many instances but little removed from savagery. These people occasionally fall under the sway of some enterprising man who organizes bands that raid the more civilized inhabitants of the lowlands. To remedy this condition the Commission is building roads as rapidly as its finances permit to open up these remote places in the interior and thus enable the work of education to begin. The railroad work which is now under consideration will also have a very important effect in encouraging commerce and industrial development in the scattered cities that are now too isolated from each other to feel the spur of competition, which is necessary for the most rapid progress.

Views of Masonry Arch, Retaining Wall, and Side Hill Work, Benguet Road, Philippine Islands.

Public works in the provinces at the time of the report were under the charge of the Bureau of Engineering, which reports to the Secretary of Commerce and Police. The head of the Bureau was the consulting engineer, Mr. J. W. Beardsley, whose staff was organized in six divisions. The division of construction was under the principal assistant engineer, Mr. J. G. Holcombe. Its duties included the preparation of standard designs, the completion of final plans and specifications, the preliminary organization of construction parties, the testing and inspection of materials, and the supervision of all assistant engineers on work not directed by experts. The division of railroads, under Mr. C. H. Kendall at the time the report was written, was intrusted with the supervision of private railroads and investigations for new lines. The division of provincial supervisors, under Mr. J. D. Fauntleroy, had charge of the construction of the roads, bridges and other engineering works authorized by the provincial boards. The division of drafting, under Mr. F. P. Reynolds, and the division of records, under Mr. F. R. Bonner, had the usual duties of such organizations. The division of surveys, under Mr. A. H. Higley, had charge of field surveys and the checking of maps, designs, estimates and reports connected with such work. The total staff numbered 42 technical men and 27 non-technical employees. The twelve public roads under construction from insular funds required 10 superintendents, 64 foremen and skilled laborers, 20 clerks and about 7,000 native laborers.

Two new divisions are much needed, Mr. Beardsley reports, one to have charge of irrigation works and the other to investigate the geography of the islands.

The importance of irrigation in the agricultural development of the islands is large. The experimental farms are needing more or less development along this line. The estates included in the recent friar lands purchase have large irrigating systems. These lands will be subject to subdivision and sale in the near future; the repair and control of irrigating works will pass from one party to several. It is desirable that the government have general control of this subject. Conflicting private interests and requests for decision and for investigations have already arisen. A digest of existing laws, the formulation of practical laws controlling this subject, and the institution of an effective working system will require extended investigations. It is believed that provisions should be made for the establishment of this work in the near future.

Information as to the interior geography of the islands is deplorably deficient and inaccurate. The need of good maps is large for use in development and administration, and the lack is more evident than in the United States before national surveys were initiated. Sources of information are almost entirely lacking. Various surveys are in progress by the constabulary, by the military, by the forestry bureau, by the bureau of public lands, and by the bureau of engineering, including work accomplished by the supervisors. No one bureau is compiling these various results, and doubtless much duplication of work exists. It would be of considerable advantage and also a matter of economy to compile data now available and to keep maps up to date.

Correct topographic maps will be of great assistance in the preliminary planning of engineering works, such as railways, highways, the improvement of waterways, irrigation, the development of water power and of water supply, in military operations both of the army and constabulary, in the administration of the government, for showing the extent of provinces and municipalities and the correct relation of towns, for the needs of the court of land registration, and for use in illustrating the resources of the islands, as public lands, forestry, agricultural products and minerals, as well as for other practical and scientific purposes. It is believed that it would be economy to establish the division of geography as outlined above, pending the prosecution of a comprehensive topographical survey of the islands.

The Gauge Problem.—One of the most interesting subjects of discussion in the Bureau has been the proper gauge to adopt for the insular railways. Mr. Kendall has collected the following data concerning the gauges in Oriental countries and the opinions of representative men.

South Africa has about 6,000 miles of 3 ft. 6 in. gauge and finds it sufficient for its needs, notwithstanding its large volume of mining traffic. The first railroad built there was 4 ft. 8½ in. gauge, and was afterwards changed to the narrow-gauge. Egypt has about 1,400 miles of 4 ft. 8½ in. gauge and 200 miles of narrow-gauge. Last year about 60 miles of the narrow-gauge was changed to the standard.

In India the English Government has a very complete and well-controlled system that has created and developed the enormous traffic of that country. Three gauges are in vogue. There are 14,346 miles of 5 ft. 6 in. gauge; 11,246 miles of meter gauge, and 968 miles of 2 ft. 6 in. gauge. In addition, 566 miles of road was under construction the past year, and 1,107 miles of new lines sanctioned, about equally divided between the broad and the narrow-gauge. Mr. C. F. Street, a prominent engineer, after inspecting this extensive system, says:

"The 5 ft. 6-in. gauge was the first introduced, but it was soon found that many roads could not be made to pay operating expenses, and it was decided to use the meter gauge in building some new roads and also to change the gauge of some of that built 5 ft. 6 in., in order to lessen the expense of operation. The South India road is a notable example of the latter, as it was originally 40 to 50 miles long and with a 5 ft. 6 in. gauge, and did not pay expenses in the hands of a private company. The India Government agreed to guarantee interest on the bonds of this road if the gauge was changed to one meter and the line extended. This was done, and at the present time the road is doing a large business, and it is found that the meter is too narrow to carry it economically. This has occurred in one or two other places in India, and in some places they have the meter gauge where they should have the 5 ft. 6 in., and in other places they have the 5 ft. 6 in. and should have the meter, and I think the general opinion is that it was a great mistake that the 4 ft. 8½ in. gauge was not originally adopted."

The small but important island of Ceylon has 331 miles of 5 ft. 6 in. gauge and 36 miles of meter gauge. Java is an island about 800 miles long and 200 miles wide, with a population of 23,000,000. It has some 1,500 miles of government (Dutch) railroads of 3 ft. 6 in. gauge and only 30 miles of 4 ft. 8½ in. gauge.

Views of Retaining Wall, and Side Hill Construction, Benguet Road, Philippine Islands.

The Siberian Railway and the Chinese Eastern are of 5-ft. gauge. The Korean Railway, the Imperial Railways of northern China, and the new Canton-Hankow Line are 4 ft. 8½ in. gauge. Of the 3,000 miles of railways in Japan, the gauge is universally 3 ft. 6 in., 500 miles being Government lines. All the railways of Central America and nearly all the lines of the countries of South America are narrow-gauge, the 3 ft. 6 in. and meter gauges predominating. The Hawaiian Islands have the 3-ft. gauge.

In the Australian countries, the warfare of gauges has been waged for years, and in 1902 the government adopted the 3 ft. 6 in. for the new Transcontinental Railway. Following is the mileage and gauges of these countries in operation in 1903 and the opinions of the various representatives of these lines:

Country.	Mileage.	Gauge.
Queensland	2,711	3 ft. 6 in.
New South Wales	3,138	4 8½
Victoria	3,335	5 3
South Australia	1,229	3 6
	507	5 3
Western Australia	1,720	3 6
New Zealand	2,291	3 6
Tasmania	500	3 6

Mr. A. C. Pendleton, railway commissioner, Adelaide, South Australia, says: "The 3 ft. 6 in. gauge was adopted by this Government for the proposed Transcontinental Railway because a great portion of our northern railway system is already on the 3 ft. 6 in. gauge, which also is the gauge in the State of Queensland, adjoining the northeastern part of South Australia. The railway system in the southern parts of South Australia is on the 5 ft. 3 in. gauge, as is also the whole of the railway system in Victoria; while in New South Wales only there exists at present a 4 ft. 8½ in. gauge."

Mr. Henry C. Stanley, chief engineer, Queensland railways, says: "Our standard gauge and the only one in use on the government lines is 3 ft. 6 in. Economy of first cost in view of having to surmount a coastal range involving heavy works was what decided the authorities originally to fix our gauge at 3 ft. 6 in."

Mr. H. McLachlan, secretary railway commission, New South Wales, says: "The gauge throughout New South Wales on the State railways is 4 ft. 8½ in., and the commissioners strongly support the adoption of that gauge throughout Australia. This gauge was adopted in the first instance when railways were established here forty-four years ago, and it was deemed by the authorities then in power to be the most suitable gauge for a modern railway."

Mr. F. Rennick, engineer in chief railways construction branch of the board of land and works, Victoria, says: "Profiting by the experience of America, the best general gauge is, in my opinion, the world's standard, 4 ft. 8½ in., and where the mileage of 3 ft. 6 in. yet constructed in any country is small compared with the mileage which may be required, the conversion of this to the standard gauge might be advisable, not otherwise. The 3 ft. 6 in. is a good gauge, and experience shows that a large traffic and fair speed —up to 60 miles as a maximum—may be reached, as engines up to 45 or 60 tons (exclusive of tender) may be used. The saving in cost of construction compared with 4 ft. 8½ in. is, however, trifling, American experience showing that the curves may be as sharp on the 4 ft. 8½ in. as on the 3 ft. 6 in."

Mr. A. B. Moncrieff, engineer in chief South Australian railways, South Australia, says: "The 5 ft. 3 in. gauge was introduced into this province about forty-three years ago, because of the report of the Irish commission about that time, and further because there was an understanding that 5 ft. 3 in. was to be the ruling gauge for Australia. After some years it was found that the 5 ft. 3 in. gauge was unsuitable for developing the sparsely populated districts, and from an economical standpoint the narrow-gauge was adopted and has proved satisfactory for the work it was intended to do. The whole trade from Broken Hill to the seaboard is now conducted over a railway of this gauge on a single line, bringing at least twelve trains each way every day, the passing places being on an average 9 miles apart. In my opinion, the 3 ft. 6 in. gauge train is admirably suited for developing country dealing with farm produce, sheep, cattle and minerals."

Mr. T. Ronayne, general manager, New Zealand government railways, New Zealand, says: "When the general government undertook the construction of railways, a uniform gauge of 3 ft. 6 in. was adopted, and the short lines which had been constructed to the wider gauge were altered. The reason for adopting the narrower gauge was a financial one. On portions of the line where grades and alignments are good our trains frequently reach a speed of 45 miles per hour, and our principal mixed trains have a time-table speed of from 17 to 20 miles per hour. With a well-maintained line of 3 ft. 6 in gauge, and with curves of large radius, I see no reason why speeds of from 30 to 45 miles per hour should not be generally run. At the present time there is an agitation in this colony to adopt for the more sparsely settled districts, a still narrower gauge, viz.: One of 2 ft. or 2 ft. 6 in., but there are great objections to this proposal on account of the difficulties in working, incidental on break of gauge. With the gauge of 3 ft. 6 in., and a minimum curve of 12 chains radius and a grade of 1 in 75, and a 65 or 70 pound steel rail, well-sleepered, an efficient line can be constructed capable of carrying a very large traffic; and, where necessary, at considerable speeds."

Mr. F. Back, general manager Tasmanian railways, Tasmania, says: "The first line built in the colony was 5 ft. 3 in. gauge, but it was found that the traffic was so limited that a cheaper class of line would be sufficient. The 3 ft. 6 in. gauge was therefore finally adopted as being more economical and quite equal to the requirements of the colony. The limits of grades is 1 in 40 with curves of 5 chains radius. Our passenger trains are able to maintain a speed of 30 miles an hour, although our ordinary trains are timed to a much lower speed."

Roads.—The road work varies widely in its character from heavy mountain construction to the hardest kind of swamp roads. For example, the Mantandang-Naujan road, in Mindoro, runs through a swamp for 3,500 ft. A space 32 ft. wide was cleared of all stumps and underbrush. Most of the work was done by men working up to their waists in water. Then two ditches 24 in. wide and varying from 8 in. to 3 ft. in depth were dug parallel to the direction of the road and at a distance of 4 ft. on either side of it. The dirt from the ditches was thrown into the 8-ft. space between ditches. The road bed had to be raised 5 ft.; this was done by hauling stone and piles 15 miles in bancas. Fifty men with bolos cut 10,000 piles in six days. The piles were 5, 6 and 8 ft. long, and from 4 to 7 in. in diameter. The wood was a swamp timber, very easy to cut when green, but very hard when seasoned. Piles of this wood were examined which after 30 years' service in salt water were found to be perfectly sound. Along each side of the 24-in. ditches the piles were driven as close as possible and in such a manner that they stood up above the top of the ditch from 1½ to 4½ ft. The piles in the outer row were inclined inward at an angle of 45 deg. They were driven 3 ft. into the bottom of the ditches, and were then wired together in the rows with No. 9 galvanized wire so that each line of piles became practically solid, and the two lines were firmly fastened together at the top in the same manner. The 24-in. ditches were then filled with stones and well tamped. Then the earth in the 8-ft. space was leveled off and a thin layer of stones placed over the entire road, after which corduroy timbers were laid and wired together, and the ends fastened in like manner to the piles along the side of the ditches which were at the ends of the corduroy.

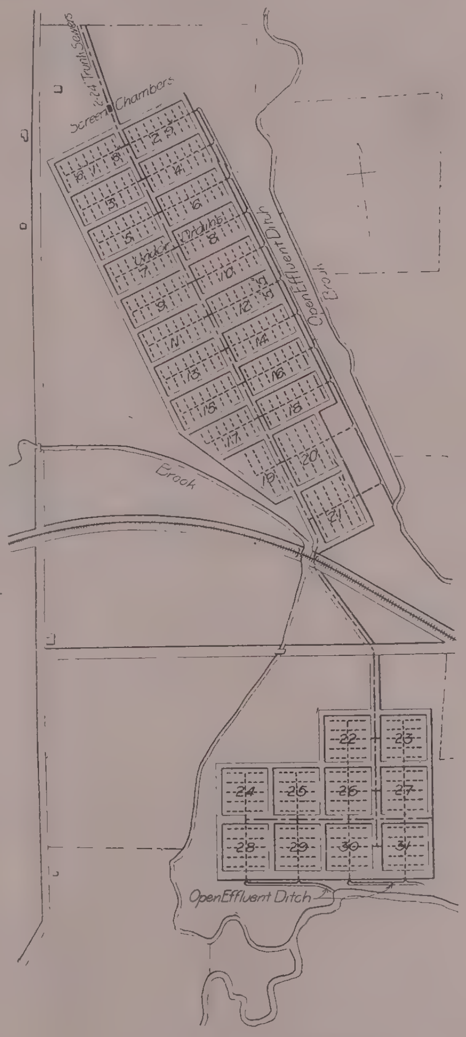
Then 8-ft. canals were begun on the outside of the 32-ft. space and gradually widened until they were 12 ft. wide at the river end and, on an average, from 2 to 6 ft. wide at the bottom and so sloped as to permit the water to drain off. All the earth which came out of these ditches was placed on the road in layers alternating with layers of stone. On completion the roadbed measured 12 ft., with a gentle slope to the canals on either side. It was then crowned with a laver of gravel hauled 15 miles in bancas, and the slopes were planted with swamp grass and shrubs, which took root and grew nicely. All the earth was handled by shovels.

The most important undertaking seems to have been the Benguet road under Major L. W. V. Kennon, U. S. A. Part of this highway had been put under construction when orders were issued to construct it so that eventually an electric railway could be accommodated. This made it necessary to change the method of construction and to make more complete surveys and location studies than had been considered essential before. Every possible route was gone over before a line was finally selected. Maps and profiles have been made on a scale of 100 ft. per inch. Culverts are of concrete and rubble masonry, and the large bridges are to be steel. Masonry has proved very expensive on account of the high cost of cement, unskilled labor and lack of machinery. The country is so rugged that standard plans have proved of little value and each structure has been designed independently. In some cases the only way to handle materials like sand has been to load them in small sacks which laborers could carry.

In carrying on the work several thousand men were employed, organized into gangs of about a hundred each, under a foreman who had to look after the food and shelter of his gang as well as its work. Two or more of these gangs were quartered together in camps. The forwarding of supplies was a difficult matter. They were sent from Manila by railway to Dagupan and then hauled by bullocks to Twin Peaks, the headquarters of the work. While the distance is but 32 miles, the haul was severe under the tropical heat, and the animals had to be watched carefully. When they showed signs of overwork they were put to pasture or stall fed until in good condition and then slaughtered for beef. Six Japanese artisans were employed making hemp shoes for these bullocks. These shoes cost little and protected the animals' hoofs very well.

The medical inspection of the men was looked after by a resident physician with several assistants. Sanitation was difficult for several reasons. A large number of the men refused to drink boiled water, and the Oriental employees overcrowded their quarters and used too much uncooked food. Asiatic cholera and variola broke out but were promptly checked. There were four hospitals on the work. The medical records show that while the white and American negro employees formed but 17.5 per cent. of the total they produced 21.5 per cent. of the cases of sickness and had a mortality of 2.25 per 1,000. The Chinese, 11 per cent. of the total, supplied 10.5 per cent. of the sick cases and had a death rate of 9.4 per 1,000. The Japanese, who numbered 22.5 per cent. of the whole organization, furnished 32.5 per cent. of the sick cases and had a death rate of 15.15 per 1,000. The Filipinos, who were 49 per cent. of the total, furnished 35.5 per cent. of the sick cases and had a death rate of 7.3 per 1,000.

Manila.—The public works of Manila are in charge of a municipal board, of which the city engineer is a member, and reports direct to the civil governor of the islands. The department of engineering and public works is directed by the city engineer, and is organized into six offices for, 1, street construction and bridges; 2, street cleaning, parks, and the collection and disposal of refuse; 3, water supply and sewers; 4, buildings, plumbing and lighting; 5, drafting and surveys; 6, city shops.



Intermittent Filters at New Britain.

At the date of the report, a year ago, the street work was in a transitory state because new pavements were being held back until sewers and water mains were laid. Contracts for Australian wood blocks on concrete had been let to J. G. White & Co. and a start in the construction of concrete curbing had been made. Water supply and sewerage work has been mainly along the line of designs and studies as recently explained in this journal. These investigations have now been completed and plans and specifications for both water-works and a sewerage system have been forwarded to Washington. Proposals for the work will be invited soon.

Intermittent Sewage Filters at New Britain.

About five years ago the city of New Britain, Conn., undertook the reconstruction of its sewerage system and the construction of sewage disposal works. At that time the subject had assumed serious proportions, and law-suits for damages in amounts of $2,000 to $50,000 were pending against the city on account of the pollution of streams by sewage. The Sewerage Board and Mr. Wm. H. Cadwell, its engineer, visited the sewage disposal systems in other cities and became convinced that intermittent filtration was the best method for their needs, provided suitable land for it could be obtained. In order to avoid pumping the sewage, it was necessary to locate the works to the southeast of the city, and after considerable search land adapted for intermittent filtration was found 1½ miles distant in Berlin. It was also decided to construct a new separate system of sewers, utilizing the old combined system as far as possible. The city has since built about 15 miles of this new system and has over 10 miles under construction, while over four miles more will be undertaken shortly, so that a year hence the greater part of the city's sewage can be taken to the disposal area.

The filters are thirty-one in number, each of about an acre, and are located on a tract of nearly 150 acres bought by the city. The subsoil of the tract to a depth of 6 to 8 ft. (and probably deeper) is, in the main, gravel and sand, with a small amount of silt and clay. It consists almost wholly of fragments of firm, fine-grain, brown sandstone, rounded by attrition in water. Before building the beds an experimental filter 0.01 acre in size was constructed. This was made by stripping the loam from the gravel and excavating a trench 6 ft. deep and 20 in. wide around the bed. This was then filled with clay puddled in tight, so as to confine the sewage to the test area. Just inside the clay wall a 4-in. tile drain with loose joints was laid and its outlet so arranged that the effluent could be examined. At first 600 gal. of sewage were turned on the bed every second day, and finally 1,200 gal. a day. This dose disappeared from the surface in less than 20 minutes. At no time was there any discharge from the underdrains. These experiments were continued for some time, and it was decided that the gravel could be safely relied on to purify from 300,000 to 500,000 gal. of sewage per acre every second day.

The filter beds have been arranged in two groups, divided by a railway and a road, as indicated in the diagram. The sewage reaches the beds through two 24-in. tile sewers ending in a screen chamber. The delivery pipe from this chamber is carried down the main embankment separating the first group of beds, and then runs across to the other group, where it is located in the main embankment in the same way. The underdrains are from 4½ to 6½ ft. deep and are 40 ft. apart. They discharge into open effluent ditches leading to the neighboring brooks.

At the present time about a fourth to a third of the city's sewage reaches the filters, and it has never been necessary to use more than three beds at any one time, and only seven have been used in all. The only analyses made of the effluent have been those of the Connecticut Board of Health, which has been satisfied with the results. Some of the beds have now been working fourteen months, but in spite of this small trout are often observed in the effluent ditch, and Mr. Cadwell states that some of them he has seen there are over six inches long. A small laboratory has been built at the filters, and a chemist will hereafter be on the works constantly, not only to observe the action of each bed, but also to study the effect of manufacturing wastes, which complicate the disposal problem. Up to the present time the beds have been giving entire satisfaction.

Plane Table Surveying, U. S. Geological Survey.

The increased use of the plane table on many kinds of surveys, particularly those of a preliminary character, intermediate between reconnaissance and location, lends special interest to the knowledge of the instrument gained in the many years it has been employed by the topographic branch of the U. S. Geological Survey. This knowledge is expressed concretely in the method of plane table work now in vogue in that bureau, which was recently described in the "School of Mines Quarterly" by Mr. Joseph A. Close. The instruments consist of a plane table board, 24 by 31 in., a Johnson tripod, a long telescopic alidade, a compass, a plotting scale, a metallic tape and a pair of field glasses. There are also a leather and possibly a waterproof case for the board and a wooden case containing the blank plane table sheets. The following outfit is also needed: A large umbrella with an iron pointed staff and connections, an ax, a hatchet, and a double-edged saw such as is used for pruning fruit trees. The last three are protected by leather cases. A pair of tree climbers and a pulley with about 200 ft. of rope for hauling flags to tops of trees are required, and a large leather gunners' haversack is useful to carry part of the outfit when on foot. The plane table sheet is a piece of heavily mounted and thoroughly seasoned paper cut 24 by 31 in. to fit the board. On it will be plotted the 5 minute projection lines to the scale of 1 : 45,000, if a 15-minute sheet, or the 10 minute lines to the scale of 1 : 90,000 if a 30-minute sheet. This will leave a good margin outside of the boundaries of the work. If the primary triangulation work has already been done, the primaries that can be plotted on the paper, whether within or without the boundaries of the sheet, will be put on with reference to the projection lines. There must be at least two intervisable points. A description of the points will be furnished and the points checked by the latitude, longitude and distance between them. The plotting will probably be found to be correct, as the points have been checked before being sent into the field. In case they have not been plotted, they will be as soon as the descriptions are received, and if, after plotting by latitude and longitude, the distance between points does not check, it is reported immediately. The positions of the primaries will now be plotted on the guide map with reference to the temporary projection lines.

The first field work will be to flag the primaries. If, as usual, there are more than two that are intervisable, the one from which the most primaries may be seen and giving the best angles between them will be left till last. On arriving at the first station to be flagged, the signal, if the usual quadripod, may be found to have been blown down and may have disappeared entirely. In that case it will be rebuilt as solidly as possible and anchored down either with rocks or logs. The flagging material will be put on in such a manner as to make the signal as conspicuous as possible.

While the assistant is finishing the flag the triangulator will spread out his guide map on the ground or some flat surface and orient it with his compass, allowing for the declination. He can decide on points where he will later put up flags. A short description will be made of them and their approximate location fixed on the guide map. If the position of the primary, which has been plotted with reference to the temporary projection lines, is not where it should be on the guide map, it is changed. This is done on each primary, and then the projection lines drawn permanently with reference to the primary locations.

On going to the last given point, which has been previously selected, the instrument will be taken along for the best checks of the plotting on the sheet. The table is set up as near the station mark as convenient and leveled by use of the striding level from the alidade. If it is at all windy, a weight will be suspended from the head of the tripod to steady the plane table and prevent accidents. The thick edge of the alidade is placed over the center of the needle pricks representing the occupied station and the most distant primary, and the table turned until the cross hairs intersect the signal. The table will now be clamped firmly and the alidade placed over the other plotted points. If the signals come in exactly on the cross hairs, as they should, the plotting of the occupied point is correct, as are probably the others.

If the triangulation is to be started from this station, nothing more need now be done with the instrument until the flagging is finished. If, however, it is desirable to start the work from some other primary, it is a good plan to draw short lines at each end of the alidade when it is sighted at the other points and is over the points representing them on the sheet. The reason for this is that since this point has been selected as the best located to check the points, the orientation is probably the best obtainable, and the table may be brought in this same orientation much more surely by using these lines at the farthest possible distance apart rather than the plotted points themselves, which are at much less distance.

By this time a good idea of the country has probably been obtained and some plan of work formed. In a sparsely settled and heavily timbered country fortunately few control points, not more than three or four to the five-minute block, are needed. Under such conditions there will probably be almost nothing that can be used as a triangulation point, so that flags are erected.

If any cleared or partially cleared knobs have been seen, they will be visited, and if it is possible to make a location there from the primaries or by the use of other flags to be put up later, it will be marked.

If the map does not show enough to make a location from itself, it is oriented by use of the compass and the point located by rough resections from those points that are in sight. A record will be made, before leaving the hill, giving the height of the flag and the names of all flags or marked points to be seen from it. Next the timbered points which have been noted will be gone to. The observer will first find out, from a treetop if necessary, if the hill is the highest in the immediate vicinity, and if so, whether the point can be located if flagged. If possible, the flag tree will be selected so that, if required, a station can be made at this point. Unless it will require too much heavy cutting, it is better to have the station on the ground, and, therefore, a tree near the highest point of the knob is selected if the flag can be set high enough to be seen over the rest of the trees. If the knob is heavily timbered and one of the tallest trees is a large one, so that a platform can be built in the top solid enough to hold the instrument and observer without swaying, it may be selected. Flagging under such conditions is hard and slow work, oftentimes not more than two or three signals being put up in a day.

It may be that the country to be mapped is thickly settled and highly cultivated, with little or no timber. In this case the work is of an entirely different character. Instead of 30 to 40 points controlling the sheet, 150 to 200 may be located, the majority of them being buildings and lone trees, flags being put up to mark the positions of subsidiary stations or upon prominent timbered hills, if any, not only to locate them, but to enable the triangulator to work around them, as they may cut off the view of some of the work from the rest.

After the sheet is well signaled, a list of all the flags to be seen from each of the primaries will be made out; also their approximate location lightly marked on the plane table sheet.

The first station will now be made and one of the most prominent triangulation points, located preferably in the southern part of the sheet, is chosen, so that when the majority of the sights are taken the observer will be looking away from the sun. The instrument will be set up and oriented as when the plotting was checked. First, foresights are taken to signals, and then, starting so that the sun may be shining on the side of the objects nearest the station while being sighted, a circuit of the horizon made, taking foresight to all prominent objects, such as cupolas, towers, chimneys, flag poles, monuments, church steeples, school houses, houses, barns, wind-mills, trees, hilltops, spurs, etc. These points are found best and their characteristics noted by using the field glasses. In sighting at buildings it is best to take a chimney, cupola or peak of roof at, say, the north or east end on every occasion, as it may happen that a shot may be taken at the same object from a different station without recognizing the point, and a third shot will be found to go through the intersection of two others, and, on looking up the descriptions, they will be found to be the same object.

The lines of sight will be drawn with a 9H pencil, sharpened to a chiseled edge, at considerable length along the thick, fiducial edge of the alidade, care being taken to always hold the pencil at the same angle and see that the contact of the rule and the paper is perfect. On all foresights to points which may afterward be used as stations, in addition to the regular line, short lines are drawn at each end of the alidade in order to get the best possible orientation when sighting back toward the first stations.

After all the sights have apparently been made, the striding level is adjusted and the ground gone over again to fix the relative positions and characteristics of the points indelibly in the mind and to take vertical angles to the points whose elevations are required. The next primary is now visited. Shots are taken at all flags or marked points which may be used as stations and the orientation lines drawn. Should any of these be points at which shots were taken from the last station, a light circle is drawn around the intersection of the lines which marks the location of the point. The field glasses will then be used to try and identify any points that may be in sight which were sighted at the other station. The descriptions are read to aid the memory. After that, new shots are taken, and the angles read.

Four "magnetics," one to each quarter, are taken on each sheet, and should this and the other primaries be situated to fill this requirement, they are taken from these points.

If there are any more primary points, they will now be occupied, and after the work on them is finished the first subsidiary station will be gone to. It will be a point, if possible, visible from at least two primaries from which shots have been taken to it. The alidade will be placed on the orientation lines, coming from the most distant station, in the reverse position to that it held when the lines were drawn, and the table oriented on the signal and clamped. The alidade will now be placed on the other orientation lines drawn to the occupied point, and if the signals show on the cross hairs of the telescope the point is not only accurately located at the intersection of the lines, but the orientation of the table when the sights were taken on the primaries is proved to be correct. All other located points in view are sighted not only to prove the station, but the location of the points themselves. The point is marked by a small hole made by a No. 10 needle. A small triangle is drawn around it and the number of the station marked alongside of it. The work now proceeds as from the former stations. Points are considered as located and are marked by a needle point when three or more shots at good intersection angles have been passed through them. A point is really located by two shots, but its location is rarely accepted until a third check shot has been obtained, unless there are other control points near and there has been absolute certainty as to the identification and the correctness of both of the shots.

All that remains is to work out the elevations of the points to which angles have been taken. This is usually done on rainy days during the work. The angles are obtained directly from the notes and the distances scaled from the sheet. By the use of tables compiled directly for this work the difference of elevation is obtained. As the control is generally a month or so ahead of the rest of the work, this is all that can be done at this time. At least two wye level elevations, say one in the north and one in the south portions of the sheet, must be given. A description of the points whose elevations are required are given to the level man, and as soon as the levels are run he will report them to the triangulator, who can then finish his work. By adjusting the different elevations obtained for each point, giving each a weight according to its value, very good results are obtained.

In heavily wooded and level country or on the prairies of the Central West it is often found to be inexpedient, because of great expense, to procure control by means of triangulation. Under such conditions it is obtained by what is known as primary traverse. It is also found advisable to use this method in country which has been covered by primary triangulation but where the points obtained are on flat tops or the sides of hills away from the work, so that secondary triangulation is impossible without going to considerable expense.

The instruments used are a transit reading to 20 or 30 seconds, a 300-ft. steel tape graduated to feet for 5 ft. at either end, a 100-ft. steel tape, a spring balance, two thermometers, four hand recorders, two flag poles, and a good watch. The party is made up of a transitman, a recorder, two tapemen and a flagman.

The work consists in running traverse lines of high degree of accuracy by means of transit and tape over railroads or highways in such a manner as to give the required control. A record is made giving a description of the starting point of the line and the beginning and ending of each day's work; also locations of railway stations, mile posts and switches passed, and roads, streams, and town, county and state lines crossed. Two permanent marks such as are used on primary triangulation stations are placed not less than 500 ft. apart at the initial and terminal points. The tape is used at 20 lb. tension and the temperature taken every hour during the work. Polaris observations are taken every night, when possible, and at distances of not more than 10 miles. When the line is very crooked, solar azimuths are taken twice a day, weather permitting, in addition to the Polaris observations. The effect of errors is practically eliminated by closing the traverse back on itself, or on some other adjusted primary traverse, or, better still, by connecting with primary triangulation stations or astronomical positions. The latitude and longitude of all determined positions are afterward computed.

In order that the contours of the finished maps may show exact elevations above sea level, part of the topographic work consists in running a system of spirit levels over the country to be worked. A sufficient amount of accurate leveling is done to place at least two permanent bench marks in each township or equivalent area, except in forest-clad or mountainous countries, where but one is established. In addition to these, other bench marks are located in prominent places where they may be of service in the prosecution of future public or private surveys. Primary lines are run over the railroads or most level highways so as to give sufficient control for flying levels and to form, where possible, either a closed circuit or one joining some other line. The allowable error, in feet, is five-hundredths of the square root of the distance in miles. Flying level lines are started from primary elevations and closed on them as often as possible. The rod is read to the nearest 0.01 and sometimes 0.1 ft. and turning points taken on any solid substance at hand.

After the plane table triangulation or primary traverse has been completed, and after or at the same time as the leveling, the roads are traversed. This work is done by one man, using a small, 15-in., square plane table, having a 3-in. box compass inserted in one edge of the board. The alidade is a brass rule, 6 in. long, graduated to a scale of 1 in 45,000 and 1 in 90,000, and having hinged sights which fold close to the ruler.

Before starting in his work he is given a sheet of paper, similar to that used on the large plane table, but of lighter grade, on which has been placed approximately the control points with reference to the magnetic declination for a one-quarter sheet. He also measures, to the nearest 0.1 ft., the right forward wheel of a buggy, which he will use for the work. He will then either make or obtain a small table converting wheel revolutions into hundredths of a mile or scale divisions. If possible, he will start his work at some control point, which he can find from the furnished descriptions. Starting at the given or assumed point, he levels his table by eye and sights through his alidade to the first bend of the road to be traversed. Then jumping into his buggy, he drives to the bend, counting his wheel revolutions by means of a piece of cloth or leather fastened to one of the spokes. On arriving there, he does not stop, but putting down the number of revolutions in his notebook, continues driving to the next bend, counting all the while. Here he sets up his table again, orienting by use of the compass and scales off the distance along the line drawn at the former station to the first bend and marks its location by a needle point. Then, using the needle as a pivot, he sights to the bend just located and draws a line along the alidade toward the occupied station. This is also located by scaling the traversed distance and a foresight taken to the next bend. Stations are made at all road junctions or crossings and the azimuths of the roads shown. Great care is taken in getting control points, not where they have been approximately plotted, but where they are shown to be by the traverseman's intersections. If they cannot be intersected easily, they are traversed to on foot, if necessary. When the streams are near the roads they are sketched in. When the roads have been leveled, the elevations painted on the fences, etc., are located and recorded on the traverse sheet. In rough country, with few roads and distant ridges and valleys, the hollows are traversed on foot, if necessary. While this takes considerable time, it is of great value to the sketcher, and often saves his more valuable time in doing the same work. State, county, town and district lines are obtained, and also names of towns, streams, hills, etc., and recorded on the sheet. When working, all the sheet, except that in immediate use, is covered with paper, small openings being made as required. A piece of paper is also pasted on the bottom of the alidade.

The final and last stage of the field work to which all the others lead up to is the sketching. This requires the greatest skill and experience, and is generally done by the topographer in charge of the work. The sketch sheet is a piece of paper of the same grade as that used in the plane table triangulation, but of one-half the size, as a full sheet is too cumbersome to handle conveniently. It has plotted on it the primary and secondary control points, the road traverse adjusted between these points, so as to eliminate all closure errors, and the elevations from vertical angulation or spirit leveling written in their appropriate places. The topographer is equipped with a Johnson tripod and plane table board to fit the sketch sheet, a small telescopic alidade, a hand level, a clinometer, and an aneroid barometer.

In open country where roads are sufficiently abundant to cut up the map with traverses so close that the topographer may not have to sketch more than one-half to one inch to either side of his position, the work proceeds as follows:

Taking the sketch sheet on the board in his lap, the topographer, for cheapness and convenience, because of the speed, drives over every road. Where these are not sufficiently near he walks in between them, pacing distance as a check, and better locating himself, when possible, by resections from fixed objects, while he sketches the plan of the contour lines as far as he can safely see them to either side of his path. This operation is performed by setting out from such fixed points as a road junction, a located house or a stream crossing, the position of which is plotted on his map and the elevation of which is known. Adjusting the index of his aneroid at the known elevation, he drives or walks along, keeping the plotted position of the road parallel to its position on the ground when driving over it, and marking on the map the crossings of contours as shown by the barometer. At every contour interval he stops, and, knowing his position on the map, follows the contour by eye or by hand level, and sketches it on the sheet. The aneroid is checked every two or three miles either from elevations already given or by new ones obtained by taking vertical angles to points in sight, whose elevations are known. In this same way he is able to compute the elevations of nearby hilltops or spurs which either he or his traverseman has located by intersections so as to aid in accurately placing the contours. He not only sketches the contours, drainage, political boundaries and other topographical features in the assigned area, but also checks the positions of houses, summits, streams, etc., as located by the traversemen.

When the hills are more prominent and the slopes bolder and steeper, the topographer sketches these from his various viewpoints by interpolating contours between located control points.

In the woods the sketching is executed in an entirely different manner. The topographer is limited to sketching that which is directly under foot, or, in other words, mere contour crossings. Not only the topographer, but his more skilled assistants, are engaged in this work. Foot traverse is run along the stream beds and ridges, and the contour crossings obtained. This work is done on small plane tables with sight alidades. Distance is obtained by pacing or by use of a light linen tape. When the skeleton of topography on the highest and lowest lines, i. e., contour crossings of streams and ridges, is plotted on his map, the topographer readily interpolates contours for most of the intermediate spaces, and fills in those places which are not fully mapped.

SUPERHEATED STEAM IN LOCOMOTIVES is regarded very favorably by Prof. W. F. M. Goss, who recently summarized its advantages as follows: Its use makes possible a better distribution of steam, it greatly improves the economic performance and capacity for work of the locomotive, it can be obtained by apparatus introduced into the locomotive without much difficulty, and the maintenance of the superheater is not likely to prove difficult nor is any trouble to be expected in securing satisfactory cylinder lubrication.

The New Williamsburg Power Plant of the Brooklyn Rapid Transit Co.

A natural result of the great growth of the Brooklyn Rapid Transit system has been an increase in the demands for power to equality with the combined output of several independent plants. It was foreseen nearly two years ago that greatly increased power facilities would be required soon, and accordingly designs were prepared for the plant now being installed in the Williamsburg district. Land fronting on the Wallabout Canal was available which would afford, in addition to the advantages of a river-front site, proximity to the rapidly growing eastern sections of the city. It also lies between the old Brooklyn Bridge and the new Williamsburg Bridge, so that the enormous congestion of traffic focusing at these points will be most easily handled.

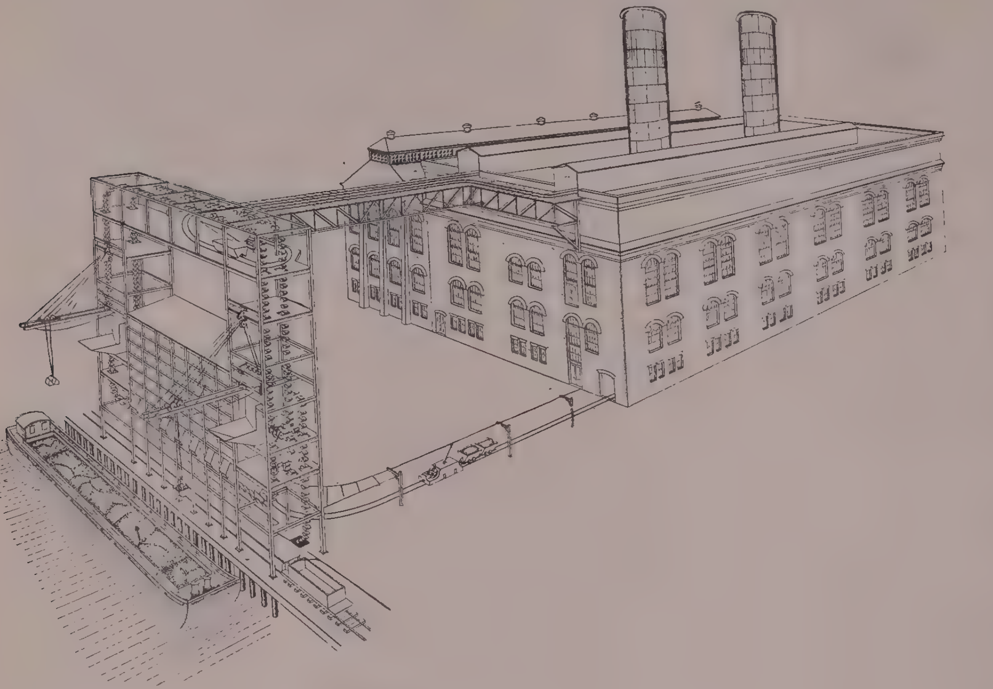
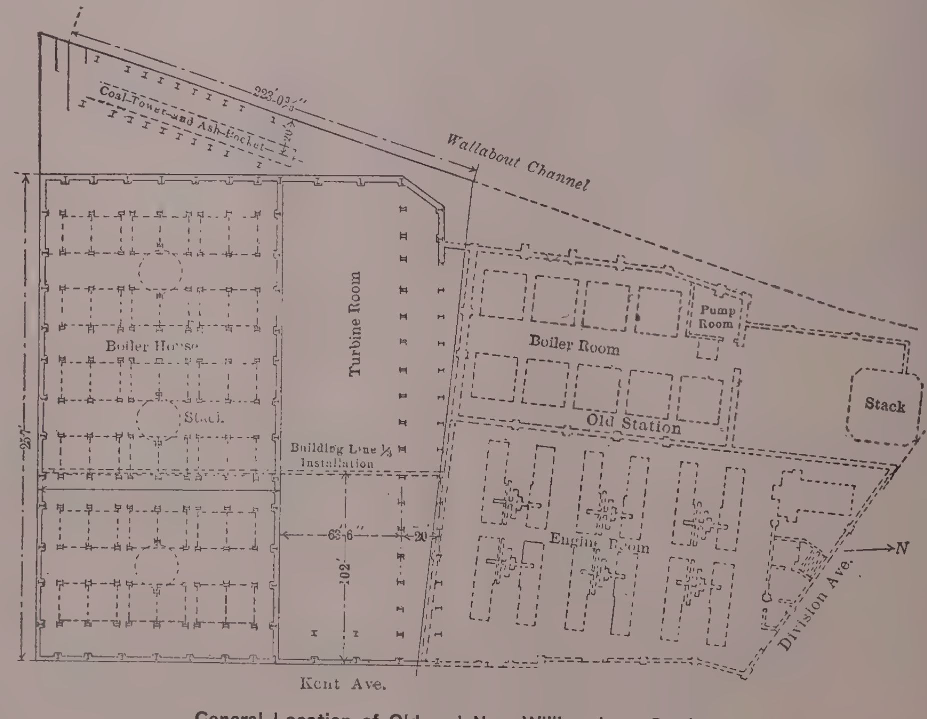


Diagram of Coal Handling Equipment for Williamsburg Power Plant.

The power house is located immediately adjoining the company's Kent Ave. station, with a frontage of 209 ft. on Kent Ave. and extending back 257 ft. toward the bulkhead line. The building is divided into an 83-ft. turbine room and a 125-ft. boiler house. For the foundations it was necessary to pile the entire area occupied by the building, the upper 10 to 25 ft. below the surface of the ground consisting of loose filling, below which was sand. The condenser circulating water tunnels, one for inlet and one for the overflow, are both 10 ft. horse-shoe concrete conduits, one above the other. They enter beneath the turbine room basement and pass longitudinally the length of the room. The boiler room has a 17-ft. basement, two 33-ft. stories for the boilers, and above this a space of 47 ft. up to the general roof level for coal bunkers; the coal-handling system will be accommodated in the roof monitors. The turbine room has an 18-ft. basement for condenser apparatus, and a main room with a clear height under roof trusses of 83 ft. On the north side of this room are five galleries above the main floor for the electrical switching equipment. Across the Kent Ave. front there is a row of mezzanine galleries for offices, locker and toilet rooms, and for mechanical and electrical laboratories.

The boiler room and turbine room floors are designed for uniform loadings up to 600 lb. per square foot, while the less important floors are designed for 250 lb.; the floors are all of concrete upon the Roebling system. In addition, the steel structure is designed to carry ultimately, above the boilers, four coal bins holding 15,000 tons when all filled. They are of reinforced concrete with vertical I-beam stiffeners at intervals. The turbine room is traversed by a 50-ton Shaw traveling crane of 62 ft. span between rails.

Boilers.—The complete plan of the boiler room provides on each floor two main firing rooms, each having a row of three batteries, of two boilers each, upon either side, and at either end of the building a half firing room with a single row of six boilers. This arrangement permits of the use of only three stacks, which will be symmetrical in design, each stack thus operating twelve boilers upon either floor, or twenty-four each. The objection to the arrangement of half fire rooms will not here prove serious, as owing to the large size of the plant it will be an easy matter to at all times divide the work between boilers to the best advantage of firemen.



General Location of Old and New Williamsburg Station.

The boilers for the new station will be supplied by the Babcock & Wilcox Company, and will be equipped with the new Babcock & Wilcox single superheaters. The station is designed for 36 boilers upon each boiler floor, or 72 in all, although for the initial installation only 36 will be installed together with two stacks. Each boiler unit will be of 650 h.p., designed to deliver steam at 200 lb. pressure and with a superheat of 100 deg. F. Each boiler consists of three 42-in. steam drums, and has 294 4-in. tubes, 18 ft. long, arranged 21 tubes wide and 14 tubes high, presenting a total heating surface of about 6,500 sq. ft. The vertical rows of 14 tubes each deliver into a continuous wrought-steel header of a new design, which materially simplifies the construction. The boilers will all be fitted with Gibson dumping grates, to the entire exclusion of stokers.

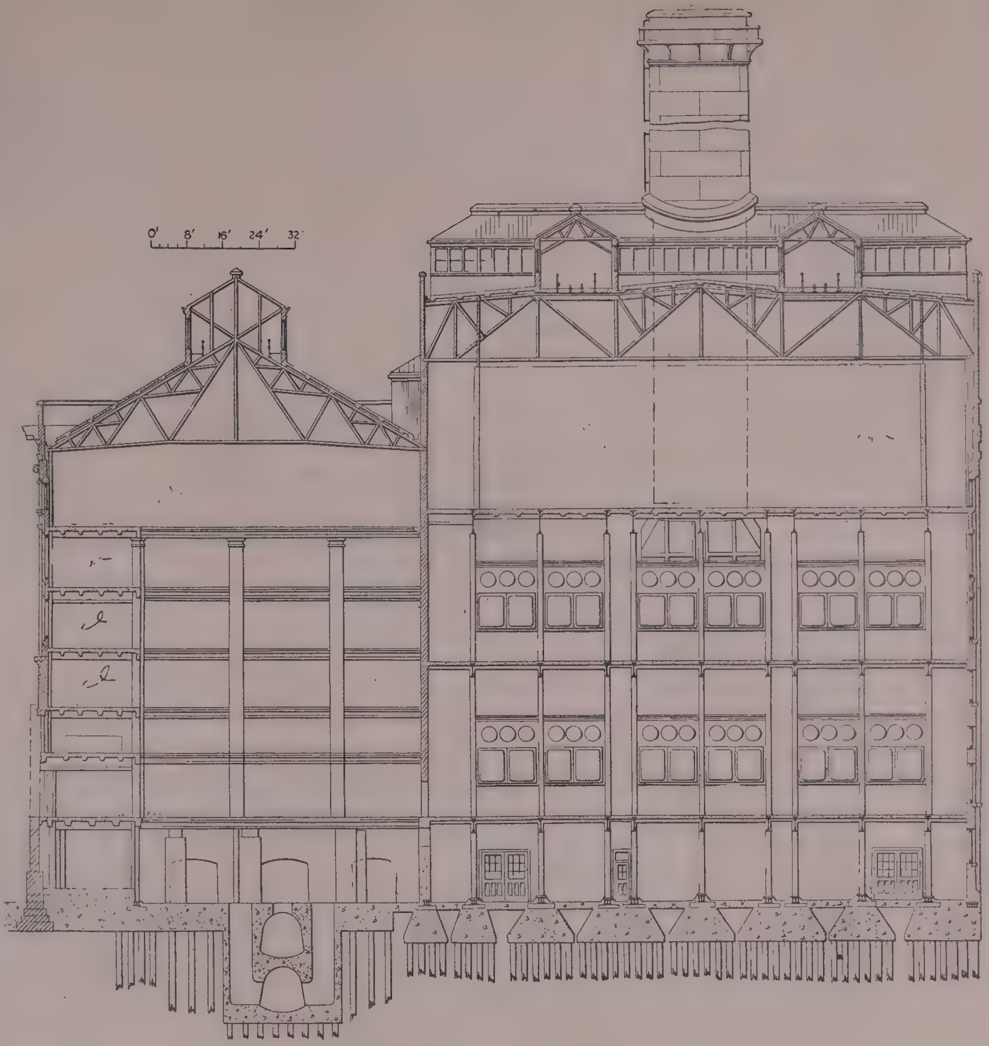
Both natural and forced draft will be provided, the latter permitting an advantageous flexibility in the burning of low grades of fuel. For the forced draft supply there will be installed two Sirocco blowers of 90,000 cu. ft. capacity per minute, for each row of six boilers. These fans, which will be fitted with cases and driving engines by the B. F. Sturtevant Co., Boston, are to be located upon elevated platforms at the sides of the boiler room or in the basement, from which position the delivery will be through ducts leading down to cross flues beneath the ash pockets. Damper openings are to be provided at each opening so that the blast may be regulated at will. Sufficient capacity is provided in each blower to operate the entire six boilers to their maximum, if at any time this is found necessary.

The products of combustion are discharged from the boiler furnaces through a large self-supporting steel stack rising to a height of 250 ft. above the first floor level of the boiler room. This stack will be duplicated for each additional 24 boilers. Connection is made to each stack through a flue and uptake which rises in the space between the rear ends of the double row of boilers up into the base of the stack. This flue structure is built up of ⅜-in. plate and 2½ x 2½ x 5/16-in. angles, having openings 3 ft. 9 in. x 9 ft. in area at the rear of each of the boilers. In the main uptake from the first to the second floors, which is 8½ x 24 ft. in section, there is a baffle plate to prevent interference of draft when one side is idle. At the second boiler floor level the flue opens out to an area of 11 x 36 ft., changing section above that to a 23½ ft. circular opening beneath the stack. The entire flue and uptake structure will be enclosed in a non-conducting covering for preventing radiation of heat into the boiler room.

The stack, which commences at the third story level, is 181½ ft. high, and has an inside opening varying from 21 ft. 8 in. at the base to 21 ft. 2 in. at the top. It consists of 33 courses, varying from ½-in. plate at the base to ¼ in. at the top. It is lined with 4-in. hard common red brick, backed up to the shell with 1 in. of concrete. This lining will be supported by an angle framework throughout the interior of the stack with horizontal members at every third plate of the shell, which will thus permit any section to be renewed without disturbing any of the remainder.

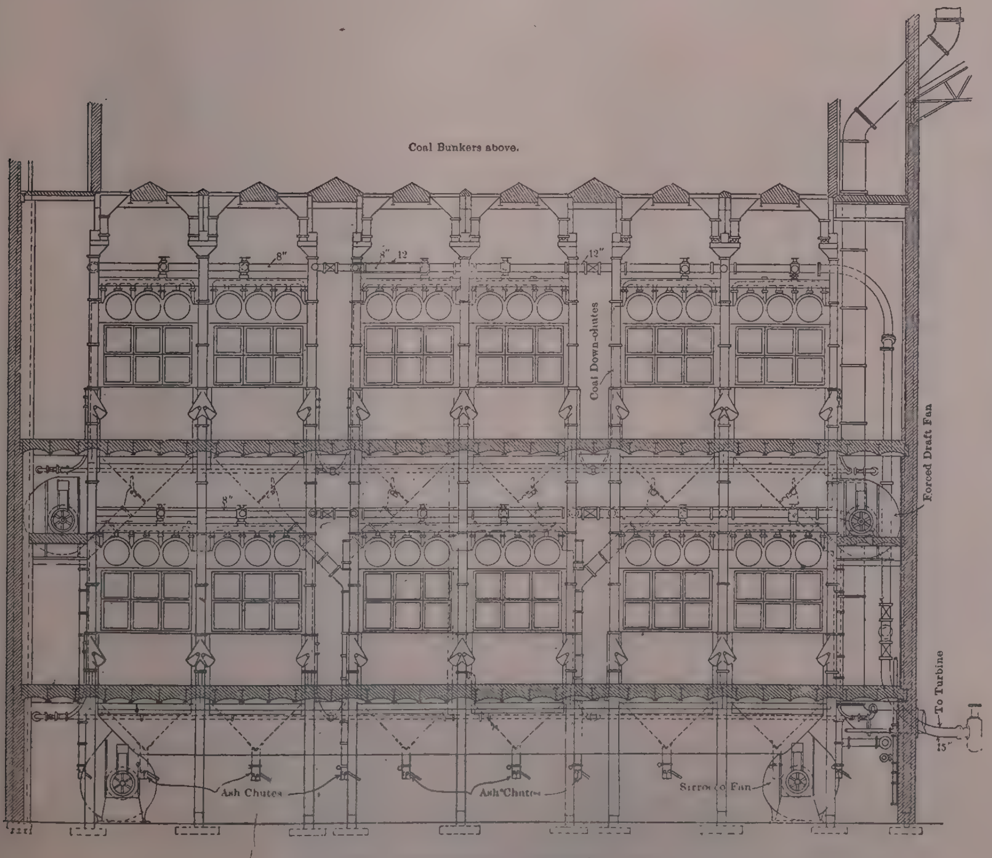
While there is no intention of installing economizers at the present, the arrangement of uptake and flue provides ample space for them toward the sides of the boiler room. Additional connections for such a purpose may easily be made from the boiler setting to the economizer, from which the outlet connection could be joined to the uptake with ease, although the middle boilers of each group are inaccessible for such a connection owing to presence of the main uptake at their rears.

Coal and Ashes.—Coal will be delivered to the new station by barges in the Wallabout Canal, and will be unloaded by coal towers, and from the towers cars upon an elevated cable railway will distribute it in the pockets over the boiler room. The towers will consist of a steel structure, 100 ft. long, 25 ft. wide and 133 ft. high, containing the barge unloading apparatus, coal receiving bins, crushers, etc., together with an ash-handling and storage equipment. The coal unloader hoist jibs, of which there are two, one at either end of the tower, are to be located 73 ft. above bulkhead level, from which the lift to the receiving bins will be 57 ft. The small receiving bins deliver to coal crushers, and thence the coal is elevated 115 ft. by two lines of bucket conveyors to the top of the structure for delivery to the automatic cable railway cars. Of the latter there are to be five of 2½ tons capacity each, which will be loaded at a rate of about two per minute, giving thus a total capacity of about 300 tons per hour. The cable railway crosses to the boiler house by a bridge and makes a complete circuit of the coal pockets above the boilers.



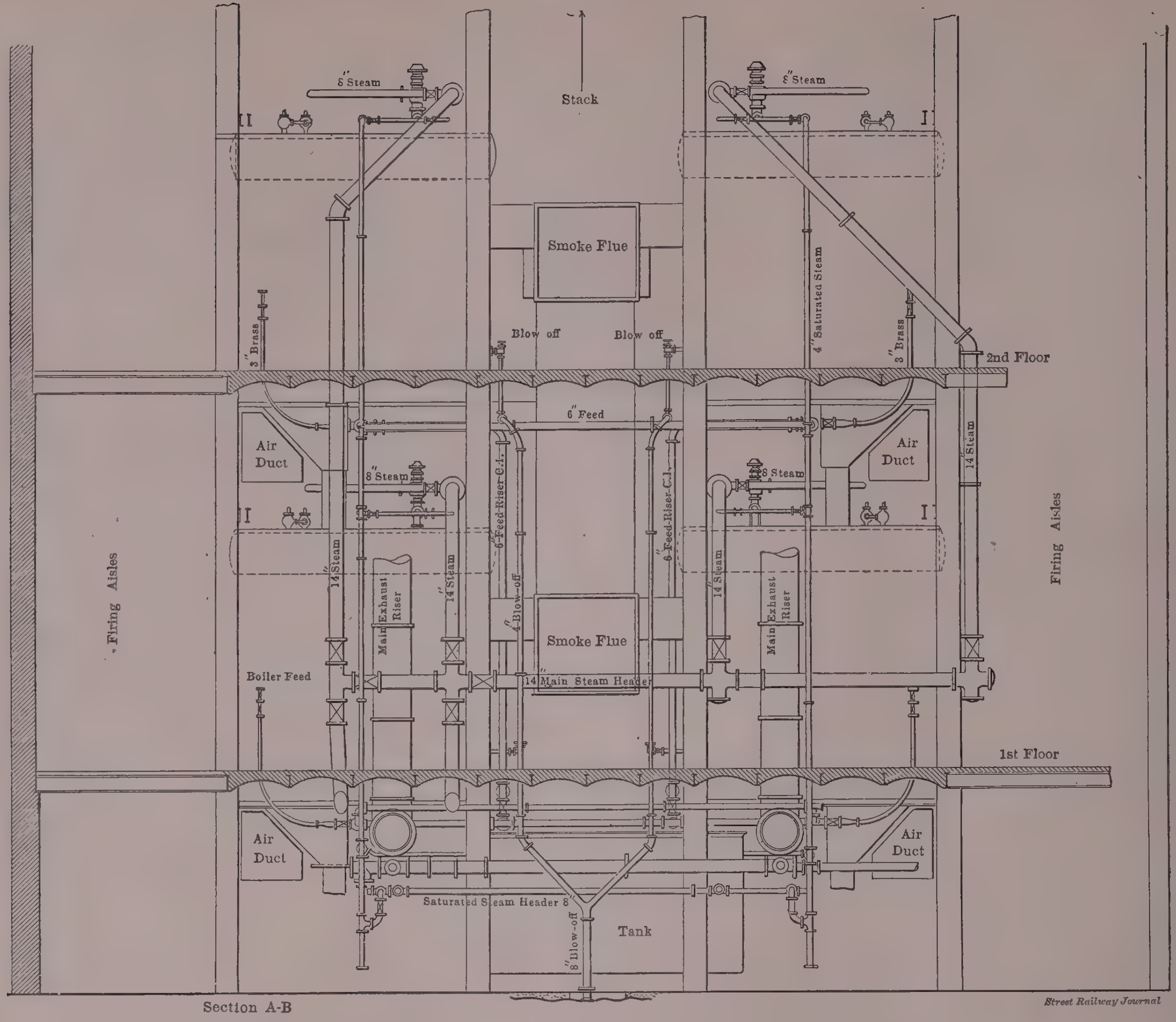
Section through Boiler and Turbine Rooms.

The coal unloading tower equipments are of the two-man type, and each is operated by a combined hoisting and trolley engine set, consisting of a double, direct-connected, two-drum, 14x24-in. engine for the bucket hoist, and a double, single-drum, 10x12-in. engine for the trolley movements upon the jib. The buckets are of the improved Rawson type, and each is 1¼ tons capacity. The coal crushers will be of the single-roll, swinging-block type, and will each be driven by a 10x10-in. single-cylinder engine. The elevating conveyors will consist of 24x32-in. buckets, spaced 32 in. apart, and will be equipped with a variable-speed motor drive, the capacity guaranteed for the system to be the handling of 300 to 350 tons per hour. The entire coal handling equipment, together with the ash handling apparatus, is being supplied by the Mead-Morrison Mfg. Co., New York.

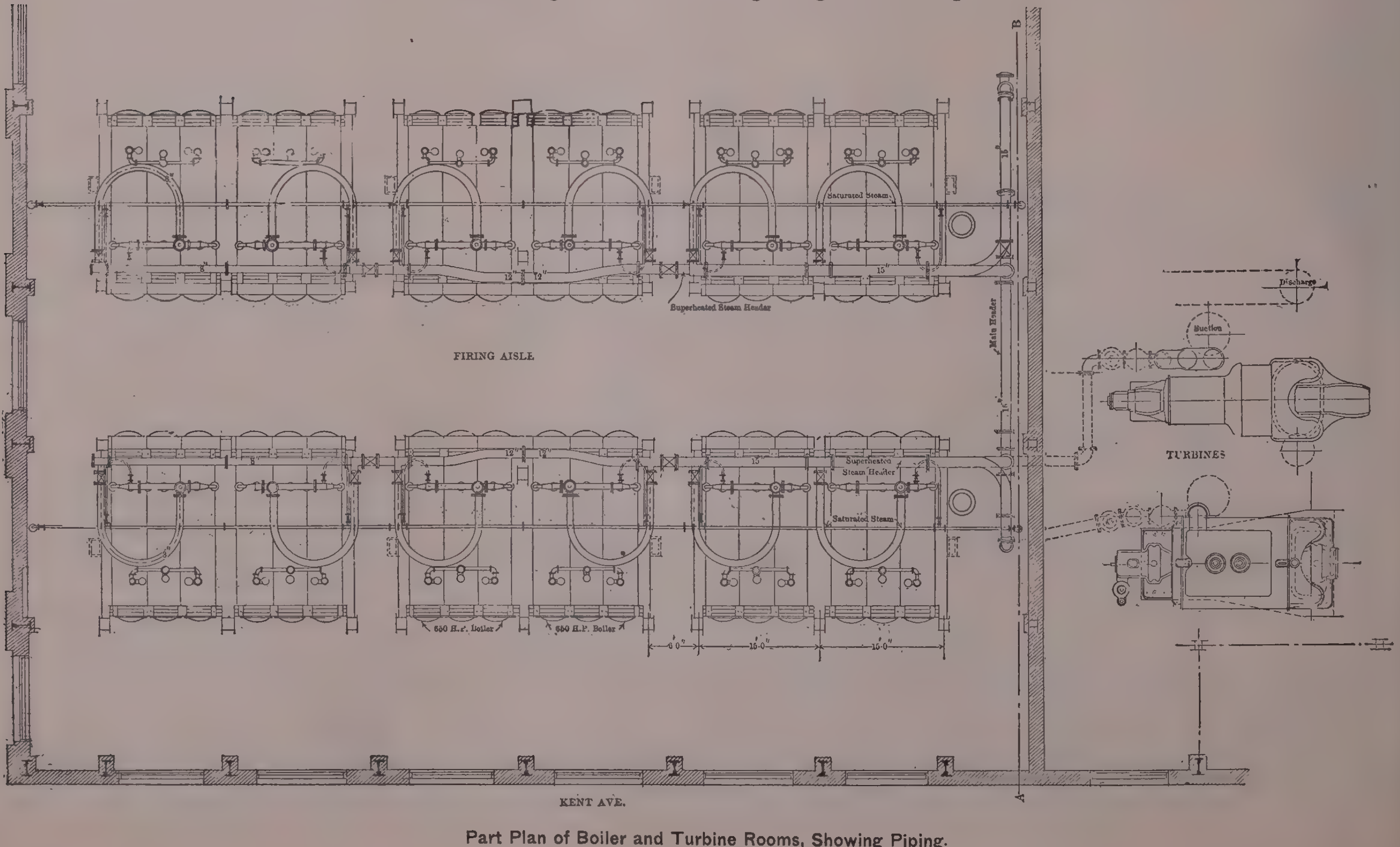


Longitudinal Section through Boiler Room.

The ash-handling system will comprise a line of narrow-gauge railway cars passing underneath the ash chutes in the boiler house basement, which will deliver the ashes to an elevating conveyor in the coal tower, raising them to a 1,000-ton ash storage pocket. Cast-iron chutes are carried from



Section through Boiler Room Showing Arrangement of Piping.



Part Plan of Boiler and Turbine Rooms, Showing Piping.

the furnace ash bins of the boilers upon both floors down to outlets over the track for dumping direct to the cars. The latter will be of the V-bottom dumping type, and will be hauled by a 6,000-lb. electric locomotive, having a capacity of drawing a total load of 14,000 lb. at a rate of about three miles per hour up a 5 per cent. grade. The ash elevating conveyor is of the bucket type and is designed to deliver at a rate of from 50 to 60 tons per hour from the receiving bin to the storage pocket. The latter is provided with outlet spouts for delivery either to wagons or boats in the channel.

Piping.—Relatively small pipe sizes are to be used, with correspondingly high velocities of steam flow, and the system of connections secured by the cross arrangement of boiler room is simplified to the extreme. From the 14-in. main steam header next to the division wall a 14-in. branch steam pipe extends up and over the rears of each six boilers, reducing in size to 12 and 10-in. toward the opposite side. There are intercepting gate valves between each battery. The battery header or branch is located about 3 ft. above the boiler settings, and connections to it from the boilers are made by heavy return bends of 8-in. pipe of 5-ft. radius. Each bend has two valves, that next to the boiler a plain gate valve and the other a non-return stop valve.

The main steam header will be of 14-in. pipe, and is to be located in the areaway alongside the division wall on the first floor, where the branch loop connections may easily be made to the boilers upon either floor. The branches to the turbines will be carried from the header through the basement, so that no piping will be visible in the turbine room, although the control of valves will be readily accessible at the machines. All of the high-pressure piping will be of wrought steel, with sheet steel gaskets in the joints, while the bodies of all valves and all fittings will be of Baldt steel.

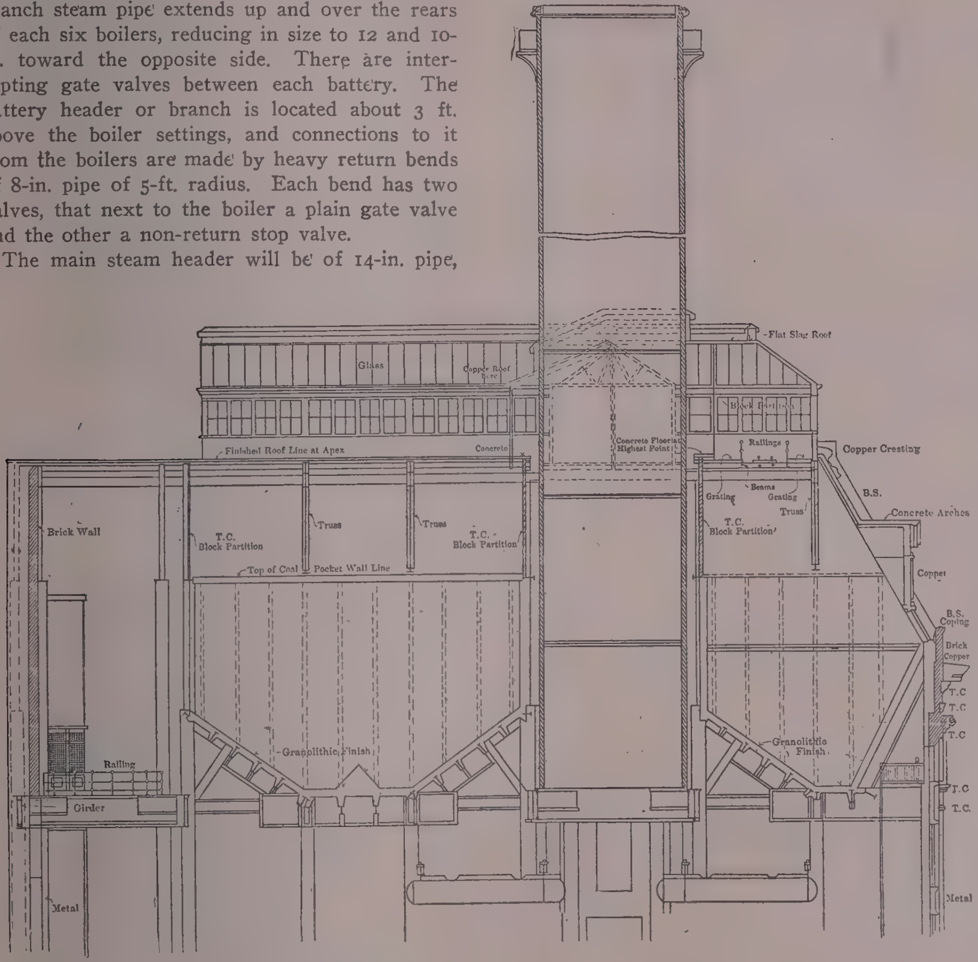


Diagram Showing General Arrangement of Coal Bunkers.

The feed water piping system has ring mains of 6-in. cast iron encircling each group of 12 boilers just below the floor level, from which branches are carried up to each boiler front, consisting of a 5-in. branch between each battery, connecting through a tee to 3-in. brass individual boiler connections. The system will thus, by virtue of the ring main, two independent feed connections thereto, and the sectionalizing valves, be thoroughly reliable, each boiler having two independent sources of feed supply, and any section of the main being capable of removal from duty without affecting the remainder. The feed water supply will be taken normally from the condenser hot well, make-up water being taken from the city mains. There will be three feed pumps and two closed, and one open feed water heater, utilizing the exhaust of auxiliary engines, pumps, etc.

The blow-off piping will consist of a single header of 4-in. pipe at the rear of each row of boilers, into which every boiler delivers through two 2½-in. brass blow-off connections. The two headers at the rear of boilers in every chimney flue space discharge downward through 6-in. connections to a tee leading to a common 8-in. discharge pipe to the condenser overflow tunnel beneath the turbine room, making thus short, simple and direct outlets for each group of boilers independently. The piping is all of wrought iron, with screw-flange joints, except the branches leading from the boiler mud-drums, which are of double, extra-heavy wrought-iron pipe. Each blow-off connection will be provided with two valves for protection from leakage, one a Best angle and the other a Johnstone straight-way blow-off valve.

Auxiliaries.—For the initial installation there will be three boiler feed pumps, which will be vertical, direct-acting, cross-compound, 500-gal. Blake pumps of the center outside-packed-plunger pattern. Each has 19 and 32-in. steam and 11½-in. water cylinders, with an 18-in. stroke. The water heater will be a Cochrane horizontal cylindrical feed water heater and purifier built by the Harrison Safety Boiler Works, and will have a capacity for heating 400,000 lb. of water per hour from 100 to 207 deg. Fahr. This heater is 15 ft. long and 8 ft. in diameter inside, and has a water-carrying capacity of 376 cu. ft. It is fitted with twenty 15x144-in. trays for the deposition of impurities, and has the usual coke bed filter for purification of the feed, while a Cochrane oil separator incorporated in the heater prevents contamination of the feed by lubricating oil from auxiliary engine cylinders. The closed heaters are of the Wainwright type, each 48 in. inside diameter, with 800 1-in. corrugated copper tubes, 7 ft. 6 in. long, giving thus a heating surface of 1,333 sq. ft. The tubes are divided into four groups, through which the water passes in succession, and baffles are used to cause the exhaust steam to pass in counter-current to the feed water.

Turbines.—The station has been laid out to accommodate ultimately nine steam turbine generating units, one of 5,500-kw. capacity and the other eight of 7,500-kw. capacity each, giving thus a total station capacity of 65,500 kw., or, with the 50 per cent. overload rating, of about 100,000 kw. At first, however, only three turbines will be installed, two of these to be of the Westinghouse-Parsons type and the other the new turbine of the Allis-Chalmers Co.

The new 7,500-kw. Westinghouse turbine units will differ in some details from the 5,000-kw. machines. It is understood that the blades are to be made longer and that other modifications of a minor nature are to be incorporated which materially affect the increase of capacity. The new Westinghouse unit will be 50 ft. long, 17 ft. wide and 15 ft. high, occupying a total floor space of 850 sq. ft., or 0.113 sq. ft. per kilowatt capacity. It will be only about 4 ft. longer than the 5,000-kw. turbine unit, while the width will remain practically the same. These turbines will operate at 175 lb. pressure and 100 deg. superheat, and the speed will be normally 750 r.p.m. Under the above conditions and a vacuum of 28 in., the steam consumption at full load is expected to be approximately 16 lb. per kw.-hour.

The generators connected to these units will be similar to the former standard Westinghouse designs for use with turbines, with the exception that they will embody a new enclosed construction to eliminate the hum peculiar to such apparatus. They are wound so as to deliver either 6,600 or 11,000 volts. As connected they will deliver three-phase current at a voltage of 6,600 and frequency of 25 cycles per second.

The unit to be supplied by the Allis-Chalmers Co. will be the first large one installed by them for commercial operation. It is of the horizontal type of 5,500-kw. capacity, operating at 750 r.p.m. It will occupy a floor area approximately 47x13 ft., and will be slightly over 11 ft. high. The generator will be a four-pole, revolving-field Bullock machine, and will deliver three-phase alternating current at a frequency of 25 cycles, it being wound to deliver either 6,600 or 11,000 volts.

The Allis-Chalmers turbine is of the parallel-flow, reaction type, similar in general construction and principle of operation to the Parsons type. One of the principal improvements made by the Allis-Chalmers Co. is in the blading. It is manufactured by machine tools constructed for this special purpose. Another departure from previous practice is in the method of securing the blades to the turbine spindle and cylinder, the blades being first inserted in a foundation ring, which is afterward secured in the turbine in such a manner as to safely withstand the high centrifugal force, instead of inserting the blades individually in the turbine.

Another improvement is the addition of a channel-shaped shroud ring, which is riveted to the ends of the blades, thereby stiffening them and preventing the effects of vibration in weakening the blades. The flanges of this channel strip are made very thin, so that if from any accidental cause the rotating and stationary part should come in contact, the flanges of the ring will come in contact without damage to the turbine, as distinguished from the case where the blade ends are left naked without protection. The use of this protecting shroud ring enables the Allis-Chalmers Co. to build their turbines with less clearance between the rotating blades and the stationary cylinder than would be possible without this device.

The speed of the turbine is regulated by a spring loaded, centrifugal governor, acting through suitable mechanism on the steam inlet valve.

The turbine is lubricated by forcing oil through a thorough system of piping by a centrifugal pump, which is driven by the turbine. The oil is driven through the system of pipes to the bearings, thence through a large cooler, and used over and over again. There is a separate direct-acting steam pump in the oiling system for use in starting up the turbine or in case of emergency.

The turbine and generator shafts are connected by an enclosed flexible coupling, and are carried in ball and socket bearings lined with a special hard babbitt metal.

The generator is constructed with special reference to safety of operation at turbine speed and thorough ventilation. Particular care has been taken in the method of supporting the ends of the coils of the revolving field, and at the same time thoroughly ventilating it, this being one of the specialties of the Allis-Chalmers construction.

The whole unit of turbine and generator measures 47 ft. 1 in. in length over all. The outside diameter of the stationary armature of the generator is 13 ft. 4 in. The greatest outside diameter of the turbine casing over the flanges at the low-pressure end is 8 ft. 10 in. The highest part of the unit, namely, the top of the generator, stands 11 ft. 6 in. above the floor level.

Condensers.—For each of the turbines there is to be installed beneath them in the basement a Worthington surface condenser, with a two-stage turbine hot-well pump, motor driven, and a horizontal rotative dry vacuum pump. The circulating water will be handled by volute circulating pumps direct driven by vertical, compound engines, short direct connections being had to the inlet and overflow tunnels beneath the basement floor. The condensers are rectangular in section, that for the 5,500-kw. turbine having 22,000 sq. ft. of surface, made up of 1-in. tubes, 17 ft. long between heads, over which the steam makes three passes. It has a capacity, when supplied with circulation water at 70 deg., of maintaining 1 lb. absolute in the exhaust passages when condensing 150,000 lb. of steam per hour. The tube heads are of Muntz metal, and the tubes are of No. 18 B.W.G. seamless drawn brass, secured in the heads with stuffing boxes of the Navy standard pattern. The condensers for the 7,500-kw. units will be of the same general design as the smaller one, but with 25,000 sq. ft. of surface; it is of the same length and height, and is sufficiently wider to accommodate the increased tube surface.

This station is being built by the Transit Development Co., an equipment and operating company subordinate to the Brooklyn Rapid Transit system. In the details of design and construction the latter company has been represented by Edwin W. Winter, president; C. E. Roehl, electrical engineer, and R. C. Taylor, mechanical engineer. Thomas E. Murray has acted as consulting engineer and has been assisted by Mr. Philip Torchio, electrical engineer, and Mr. G. A. Orrok, mechanical engineer.

Drying by Superheated Steam has been found particularly satisfactory where a great output is more important than maximum economy in fuel consumption. At the Merrimac Mills at Lowell, exhaust steam at about 5 lb. pressure is heated to 600°, drying cloth in about one-third the time required with saturated steam.

New Paint Conditions Existing in the New York Subway.

A paper by Maximilian Toch in the "Journal" of the Society of Chemical Industry.

The steel structure of the New York subway was painted for the purpose of protection against rust, and the engineers who had charge of this were guided by their past experience, and endeavored to specify what they thought was best and would last longest. It must be taken into consideration from the outset that this investigation is by no means any reflection on the specifications as they were written, nor in the remotest sense a criticism of the materials that were used.

Briefly stated, the steel arrived on the work treated with a coat of pure red lead and pure linseed oil, and having been placed in position, competent men were put in charge; the structure was cleaned and given one heavy, good, continuous coat of pure red lead and pure linseed oil, the specifications calling for 33 lb. of red lead to the gallon of linseed oil. All the exposed steel work was coated with pure white lead and linseed oil as a final coat. Chemical analyses were frequently made of the paint materials.

The work on the Fiftieth St. section was completed first, and two years and three months after the application of the final coat of paint it was noticed that at this section, while the paint appeared to be in good condition, it showed long hair line cracks, and if a knife blade were inserted under these cracks large sheets of paint were pulled off, all of them carrying rust varying in thickness. The engineers in charge very kindly granted me permission to make an investigation as to the cause of this oxidation under the paint, and it gives me very much pleasure to be able to report publicly on this subject with the consent of the engineers.

The rust underneath the paint appeared under the miscroscope to be distributed in a laminated condition, or, more graphically described, my analyses showed that the oxidation was progressive in leaf-like layers. The rust had alternate light red-brown and dark brown layers, the light brown layers having the composition equivalent to $Fe_2O_3+2H_2O$, and the blackish brown, $Fe_3O_4+H_2O$. The percentage of iron varied between 55.6 and 64.9 per cent. and the water between 5.87 and 6.8 per cent.

This, then, would preclude the possibility of mill scale having caused the oxidation, but from the photomicrographs already referred to it can readily be seen that the flakes of red lead were so large and the air bubbles which they carried so thoroughly encysted that the material in this case probably acted as a rust producer instead of a rust preventive.

In a paper before the American Chemical Society, on March 20, 1903, I gave it as my opinion that a dried film of linseed oil is not porous, excepting for the air bubbles which may be bedded in it, but that any dried film of linseed oil subjected to moisture forms with it a semi-solid solution, and the moisture is carried through the oil on to the surface of the metal. We then have two materials, which, beyond a doubt, have sufficient inherent defects to produce oxidation under the proper conditions, and, granted that the percentage of carbon dioxide in the air of the tunnel is not beyond the normal, the fact that carbon dioxide together with moisture would cause this progressive oxidation is sufficient warrant for the discontinuance of paints that are not moisture and gas proof. Dr. Lewkowitsch demonstrated in his Cantor lectures that the fats and fatty oils hydrolized with water alone, and linseed oil is hydrolized to a remarkable degree in eight hours when subjected to steam. It can, therefore, be inferred that water would act on linseed oil without the presence of an alkali, and calcium added to water simply hastens the hydrolysis, leaving the inference that lime is the catalyser. This, then, bears out my previous assertion that a film of linseed oil (linoxyn) and water combine to form a semi-solid solution similar in every respect to soap, and, inasmuch as we have lime, iron, lead and similar bases present in many paints, it is almost beyond question that these materials aid in the saponification of oil and water.

For nearly three months, beginning with January and ending with March, I kept a strict record of the temperature, humidity, vapor density and dew point of the air in the subway, and I particularly selected these months as being the driest in this climate. Our winters here, excepting on such days when we have a thaw and a rain, are considerably below normal in point of humidity. Condensation on the posts of the subway is normal, and a high dew point is abnormal at this season. For this purpose I carefully registered the conditions according to Lambrecht polymeter, and, though the temperature of the subway may have been on a very dry day, say, 50 deg., if it were sufficiently cold outside, the post itself may have been 40 deg., or lower, owing to its direct conductivity with the outer air, and in such a case condensation would take place on the posts, even though the relative humidity and dew point were not excessive. It will, therefore, be seen that a pigment compound with linseed oil is not fit for subterranean work.

We have evidently learned a very valuable lesson on the action of linseed oil paint in the New York subway, and if it has done nothing more, it has, at least, taught chemists and engineers that, in places where there is vapor pressure, condensation and abnormal humidity, a linseed oil paint and a pigment are useless. A paint, therefore, which will not saponify or hydrolize should be used for all subterranean work.

From the examination made of the rust taken from the subway I cannot draw any average of composition. The wide differences are due to the fact that some of these particles of rust were carefully selected as to color, the light ones having the probable formula of $Fe_2O_3+2H_2O$. The darker ones $Fe_3O_4+H_2O$. The percentages of moisture vary between 5.87 and 6.80, and from the laminated structure of the rust and the figures obtained, it is possible to deduce that the rust in the subway is a mixture of $Fe_2O_3.2H_2O+Fe_3O_4.H_2O$.

There must be no misunderstanding on the subject of any existing danger of continued oxidation to the posts in the subway for the following reasons: That the present paint is being scraped, and that the factor of safety is so great that even if the posts were left uncoated it would be very many years before any appreciable difference could be detected. At the same time it is an object lesson to us all on progressive oxidation, and in connection with this I have lately examined the steel pier at Atlantic City, N. J., which was finished on April 3, 1898, and from which I picked with a penknife in the places covered by the mean tide scales from ¼ in. to ⅜ in. in thickness. A pier of this kind is absolutely no test for paint, because the cyclic oxidation produced by salt water is similar to that of carbon dioxide, and a great number of the salts, ammonium chloride in particular, will produce progressive oxidation which in time may probably destroy the object itself.

A Gas Engine Canal Boat has been tested with what seem to be encouraging results on the Bridgewater canal in England. A 60-ton barge was fitted with a 20-h.-p. gas engine, which took up but a small amount of space at the stern. The gas was carried in ten steel cylinders 15 ft. long and 10 in. in diameter, which held a supply sufficient to run the boat 50 miles.

Book Notes.

A concise and readable discussion of the leading features of reinforced concrete as executed in Great Britain and Europe is given in "Concrete-Steel," by W. Noble Twelvetrees. The properties of concrete and steel and their relations in a compound beam are explained, and rules are given for designing beams and columns. Some of the data and rules are not accepted as reliable by many engineers, but this is not stated by the author. Moreover, the data in different parts of the book are not always in accord, a fact that is doubtless due to the variety of sources from which they have been obtained. The book as a whole, however, is a satisfactory outline of the subject. There is a practical side that is only touched on, and this ought to be amplified in future editions. The leading defect in reinforced concrete construction at present is the poor quality of the workmanship. The molds are generally well made and well handled, the reinforcement is properly selected and placed, but the concrete itself is poor. This is not because the materials are unsuitable but because the preparation and placing of the concrete is handled in the rough way adopted for work on heavy foundations and other large masses. A good feature of the book is the collection of references to the literature of reinforced concrete, which direct the reader to more complete discussions of the various features of the subject than can be given in the limited compass of this volume. (New York, The Macmillan Co.; 12mo., $1.90.)

An important discussion of the broad problems of street railway construction, operation and management in a large city is unquestionably contained in Mr. B. J. Arnold's report entitled "The Chicago Transportation Problem." This was originally made to the authorities of that city and was published in a very limited edition for private circulation. The value of the report has led to a large and increasing demand for it and it has accordingly been reprinted for sale at $5 by the McGraw Publishing Co. As the report was fully reviewed in this journal when it was first made, it is unnecessary to print any critical notice of it now. It is in six parts. The first is a general discussion of street railway systems and the conditions governing them. Large cities are divided into three classes, and the earning capacity per mile of the railways in each class is discussed. Part two takes up the situation in Chicago and recommends certain improvements. Part three is a study of population and traffic, and contains many valuable data concerning the large cities of the world. An exhaustive analysis of the traffic in Chicago is made in such a way that the discussion is of direct value to those studying similar problems elsewhere. Special attention may be called to the tabular itemized statements of the cost of maintenance and operation of the Chicago cable and electric roads. Part four discusses the relative merits of operating cars over through routes as compared with downtown terminals, and the question of transfers and fares. In part five Mr. Arnold gives his recommendations for a reorganization and unification of the Chicago street railways and an estimate of the gross receipts from all sources. In part six, which is in nine chapters, the plans for the reconstruction of these lines, including the building of a subway, are described at length.

Dampfturbinen. Entwickelung, Systeme, Bau and Verwendung. By Wilhelm Gentsch. Hanover, Helwingsche. Verlagsbuchhandlung; 10½ x 7 in., 404 pp.

The painstaking diligence in collecting data which is characteristic of all good German books is united in this volume with a well-balanced analysis of the various problems of the steam turbine design, construction and operation. Unlike most books on the subject it is not surcharged with mathematical fireworks based on questionable assumptions and producing results of no value to anybody. It explains the development of the various types of turbine, describes their details with the help of many good illustrations, and points out those features which most clearly characterize their design. The book also particularly explains the variations in design brought about by the diversity of uses for which turbines are intended. A very large part of the published data concerning these prime movers relates to turbo-generators, but marine propulsion and the operation of centrifugal pumps and blowers introduce new conditions which affect the design.

The most important feature of the book is, however, the author's attempt to devise a general classification of turbine machinery. A great deal of confusion has been caused by the adoption for steam turbines of the inaccurate terminology of water-wheels. Gentsch suggests the terms velocity and pressure turbines for the two extreme classes represented by the de Laval and Parsons machines, and adduces some strong reasons for doing this. These names are better than any previously suggested and their adoption would do much to simplify the present unsatisfactory condition. There are, of course, turbines which must be assigned to one or the other of these classes only tentatively. A great deal still remains to be determined concerning the real action of the steam in some types, and probably it will be a number of years before a few of the mixed machines can be definitely classified. This does not detract, however, from the value of the author's generalizations, which have been much needed to put the turbine on a really scientific basis..

Mechanics of Materials. By Mansfield Merriman. Tenth edition. New York, John Wiley & Sons; cloth, 8vo, 518 pp.

Twenty years ago the first edition of this well-known book appeared and the publication since then of some eighteen thousand copies of it is ample proof of its intrinsic value. In the tenth edition the book is essentially a new one. The material in the last edition has been rearranged, condensed and amplified, so that the present book is about half again as large as its immediate predecessor. In this complete revision none of the excellent characteristics of the older editions have been lost. Clearness of statement, well selected problems and insistence on a thorough comprehension of the phenomena of stress are still characteristic of the volume.

Inasmuch as the earlier editions of this work have done much to establish the manner in which the mechanics of materials is taught in American schools, it should be pointed out here that Professor Merriman has seen fit to change materially the steps in his development of the subject. He now begins with the discussion of elastic and ultimate strength and elastic and ultimate deformation. Then comes a chapter on the materials of engineering, which has apparently been introduced at this point in order to emphasize the fact that the whole book relates to the behavior of materials under stress and is not exclusively a branch of mathematics. In fact, the author states that no recitation or lecture should be held without having test specimens at hand with which to illustrate the physical phenomena. A number of cases of simple stress are taken up after this discussion of engineering materials, and then come four chapters on the various types of beams. Columns and shafts each have a chapter, and so have apparent combined stresses. The chapter on compound columns and beams is noteworthy for its section on reinforced concrete columns and beams. Formulas for beams are deduced with and without consideration of the tensile strength of the concrete, and the uselessness of great theoretical accuracy for practical formulas is pointed out. The chapter on resilience and work presents these subjects more fully and completely than in the earlier editions, and that on impact and fatigue is also much improved. The discussion of true internal stresses and that of the mathematical theory of elasticity are particularly useful in showing the nature of the assumptions made in what may be called the ordinary working theories. There is a chapter on guns and thick cylinders, one on rollers, plates and spheres, a number of miscellaneous discussions, and a collection of tables sufficient for the solution of the problems in the book.

It is difficult to say anything critical about a book so widely and favorably known as the ninth edition of this work. It is just as difficult to criticize in detail this new edition; it is an improvement over the other almost entirely through its material enlargement, thus permitting a better arrangement of the contents and the introduction of discussions of subjects which have only lately become of technical importance.

The Effect of High Temperatures on Steel.

The effect of high temperatures on steel has been investigated by Prof. B. Hopkinson and Mr. F. Rogers, who gave their discoveries in a paper read recently before the Royal Society. Gray, Dunlop and Blyth have measured the modulus of rigidity and Young's modulus in steel heated to 100° Cent., and Martens has determined the effect on the ultimate tensile strength when the temperatures are raised to 600°. The Hopkinson and Rogers tests were made in a vertical electric resistance furnace specially arranged for the purpose and giving temperatures up to 800°. The test pieces were 0.2 in. in diameter and 4 in. long, and loaded with an 88-lb. weight. The temperature was measured by a thermo-couple at each end and the center, and the changes of length were measured to 1/50,000 in. by a Ewing extensometer. The experiments show that as the temperature rises the stress-strain relations undergo a remarkable change, the elastic properties becoming sluggish in their manifestations. At high temperatures steel behaves like india rubber or glass; if it is stressed for a time and the stress removed, it does not recover wholly at once, but after the first elastic recovery there is a slow contraction perceptible for many minutes.

A Long Siphon is used by the Guernsey Water-Works Co. to furnish water from one quarry pit to another, whence it is pumped for use in greenhouse estates. It is 1,272 ft. long, the distance from the supply pit to the summit being 1,161 ft. and from the summit to the storage pit 111 ft. The highest water level in the first pit is 4 ft. above that in the second, and the ground between them rises about 12 ft. higher still. The cost of cutting a trench in the very hard granite was prohibitive of a gravity main, and the siphon was accordingly constructed. It was laid with 4-in. bell-and-spigot pipe 9 ft. long, and unusual pains were taken to have the pipe line tight and laid accurately to grade. The joints were made with lead and yarn in the usual way, and then coated with hot pitch. Neither has a gate, but both are extended as far as possible into the water. At the summit is an air vessel with a glass window for inspecting its interior. Air can be removed from the top of the chamber by a Koerting ejector operated by water from the force-main through which the supply to the greenhouses is pumped from the quarry pit. It takes about 20 minutes to charge the siphon with this ejector, and the whole equipment works satisfactorily.

Letters to the Editor.

Rapid Pipe Laying.

Sir: I send herewith a short account of extra work which was done under the contract No. 10, which exhibits some of the celerity with which the T. A. Gillespie Co. has been doing some things in Pittsburg. As part of the work contemplated under the filtration and improvement of the water supply of Pittsburg, Pa., there is being laid a 50-in. steel pipe line about 5 miles long extending from Highland Reservoir No. 2 to the south side of the Monongahela River.

Some portions of the city proper, in the high territory supplied out of the middle service reservoir, have not had adequate pressure for some time and it was seen that if a portion of this 50-in. line could be used and water introduced into it from the middle service reservoir, instead of the low service reservoir, this territory could have better pressure until permanent arrangements were made and until the time when the new 50-in. line will be needed to take the filtered water to the south side. Accordingly steps were taken to lay a short connecting line from the high-pressure line out of Highland Reservoir No. 1 and connect around into the new 50-in. line, just after leaving the gate house of Highland Reservoir No. 2. It was also arranged to make a connection from the 50-in. line at the corner of Penn and Negley Avenues into the 20-in. main of the service system, to give the water to the district needing the same.

The new line is made of 30-in. lock bar pipe, ¼ in. thick, and is about 2,400 ft. long. The pipe was made of plates rolled at the Carnegie Mills at Homestead. The pipe itself was manufactured at Paterson, N. J.; the plate is ¼-in. thick, and it is principally in the making of this pipe that the rapidity is shown.

The chronological history, in brief, is as follows: Surveys were started July 31st; profiles of the line were furnished to the contractor August 5; plates were shipped from Homestead from August 9 to 13 inclusive, and arrived in Paterson, N. J., from August 11 to 15, inclusive; the shops commenced to manufacture pipe August 12, and began to reship pipe August 15; the first three cars of pipe arriving in Pittsburg August 19, and the balance of eight cars arriving in Pittsburg up to August 22, inclusive; there was also a 30-in. Venturi meter made under rapid orders, which arrived upon August 30; the entire line, including all connections, gates, blow-offs, etc., was completed, tested, and water turned on, on the night of Sept. 1. When it is realized that this called for 120 tons of pipe, of which the plate had first to be rolled and two long rail shipments to make, it is really a phenomenal piece of work.

In the view of the curve at the lowest point in the valley, it will be noticed that because of lack of facilities at the present shops for making short section of lock-bar pipe, that the curve and angle piece were made of riveted steel pipe. The illustration of the curve at the foot of the hill, as it rises to connect to the 50-in. main, near the gate house at Highland Reservoir No. 2, shows the back timbers used at the bottom as temporary means of anchoring until concrete could be put in place. Here, also, riveted curved sections were used. Another view of the curve in the pipe as it comes up the hill to Highland Reservoir No. 2 shows the line partially back filled on the slope of the hill.

The connection between the 30-in. line and the 50-in. steel pipe is also shown. The connection is a cast steel saddle with bell, cast iron specials and reducers, between which is placed 24-in. Ludlow valves. Trusting the above may be of interest to you, I am

Very truly yours, M. Knowles.
Chf. Eng., Bureau of Filtration.
Pittsburg, Sept. 12.

Connection of Thirty and Fifty-Inch Mains.

Line to Highland Reservoir.

Curve at Lowest Point in Valley.

Steam Joints.

Sir:—I note that on page 290, issue of Sept. 9, in the article descriptive of the New York Edison Co.'s new power plants, reference is made by a drawing and in the text to the Rockwood patent pipe joint. It is, however, not given that name, but is referred to as the Van Stone joint. Inasmuch as Mr. Van Stone merely manufactured for the writer the first joints of this description ever made for commercial purposes at the time when he (Van Stone) was superintendent of the Walworth Mfg. Co., the contractors, and did so wholly from the drawings and designs of the writer, without adding thereto anything original with himself, and inasmuch as the form of joint shown is a copy of a patent, No. 580,058, taken out by the writer, and further, fully described at the time in your journal, is it not about time that the name be changed?

Yours respectfully, George I. Rockwood.
Worcester, Sept. 11.

Faulty Conclusions Drawn from Cement Tests.

Sir:—A paper read before the American Sosiety for Testing Materials by Mr. W. A. Aiken and published in The Engineering Record July 8, 1905, under the title: "Low Pulling Portland Cements," and Mr. Bernard Enright's reply to it of July 29, in which he rightly complains about the conclusions drawn by Mr. Aiken, induce me to publish some data which I hope will cause an early abandoning of certain unjust specifications for cement in vogue in this country.

As a brief summary of Mr. Aiken's paper may be regarded the following specification adopted by a number of railroad companies: The cement must show a minimum increase of 15 per cent. in 28 days' tests over 7 days' tensile strength tests, when tested neat, and 25 per cent. for the same period in sand briquettes, 1 cement and 2 sand. This rule had been adopted as the result of the testing of 100,000 barrels of Portland cement at the institute which Mr. Aiken superintends, and his paper, corroborating the first experience, has been published after 2,250,000 barrels of Portland cement had been tested.

The vast number of tests which formed the basis for the conclusions drawn by Mr. Aiken is very apt to make a person believe that there cannot be any doubt about their correctness, that low pulling Portland cements have to be preferred to those of high initial strength and that the "accepted cements" in his paper are better than those "turned over" and "rejected." And yet the truth is, as Mr. Enright points out, that during the testing of all these 2,250,000 barrels of Portland cement the very best cements have always been "turned over" and "rejected," while the cements of poorer qualities have been accepted. The mistake does not lie alone in the conclusions drawn from the accumulated tests

(Mr. Enright shows in his table that the three years' sand tests prove the superiority of the rejected cements over the accepted cements), but the entire method of testing the cements is wrong, the cements have not been submitted to tests which permit of trustworthy conclusions as to their real value as building material. It is a pity to see how far this country, that can justly claim to manufacture the most reliable cements owing to the rotary kiln process, is behind time in the way of testing cements.

View of Curve at Foot of Hill near Gate House, Highland Reservoir.

Mr. Aiken admits in his article that sand briquettes are to be preferred to neat briquettes in determining a cement's value. He has tested exclusively mixtures containing 1 cement to 2 sand. If he would have tried other proportions, too, for instance, 1 cement to 3 sand or 1 cement to 5 sand, thus approaching more closely mortars used in actual practice, he would have arrived at entirely different conclusions, as I will show later on. But cement mortars are subjected to tensile strength only to a very slight degree in actual work, they are almost entirely submitted to compressive stress, and the compression strength therefore is that which has to be tested for the determination of the value of a cement and only conclusions drawn from compression strength tests should be admitted in formulating specifications for the acceptance of cements. In Germany tests on compressive strength on 3-in. cubes, 1 cement to 3 or 5 sand, are almost exclusively made nowadays, or tensile strength briquettes may be made at the same time, because they require less time, but in no case is it allowed to draw conclusions from tensile strength briquettes, the specifications of all contracts prescribe that only compressive strength tests shall determine the value of a cement.

A proof of how misleading neat cement tests are and an attempt to explain the fact that neat cement briquettes of high initial strength gradually decrease in tensile strength in spite of their being superior to low pulling cements is the subject of a paper read by Dr. W. Michaelis, Sr., of Berlin, before the Association of German Portland Cement Manufacturers in February, 1905. This paper has been welcomed as a very valuable contribution to our knowledge about cement mortars and the association has been asked by its members to spread the data contained in the paper with a view of inviting cement consumers of all countries to abandon tensile strength tests, or at least to adopt specifications based exclusively on compressive strength tests. In the following I take pride in translating parts of the paper mentioned:

"In the first place I shall once more refer to the cement, the strength of which I reported to you 2 years ago for the first 28 days of its hardening. For this we have found the results given in Table I. From this table you will see, first of all, that this cement mortar terminated its process of hardening after the lapse of a year; after two years practically the same strength was found, and the ratio of compression strength to tensile strength was 13 at its maximum. You will, however, be astonished—though, perhaps, most of you will know the fact—to learn that this cement, neat, attained its maximum tensile strength after 7 days, that it did not increase subsequently, but that after one year, the tensile strength had considerably decreased, and after 2 years likewise.

"It is quite evident that the cement had increased in strength up to one year and two years and yet the tensile strength had decreased. I formerly described this as a molecular change, as an increasing brittleness in the cement. That is merely a general way of expressing it, but it does not explain the process. What may be the cause of it? Let us contemplate the process of hydration of the cement. When I take 100 parts by weight of a freshly calcined cement; that is to say, fresh clinker, with a specific gravity of 3.2, these 100 parts occupy a space of 31.25 parts by volume. This cement had, as far as I remember, been beaten into the molds, as customary, with 18 parts of water; but we had better use 20 parts of water, as that will be nearer the quantity which the cement can absorb when completely hydrated. Therefore, when these 100 parts of cement are tempered with 20 parts of water, this makes 20 parts by volume of water. We therefore obtain, apart from the pores (and there are very few pores present in a neat cement beaten into the molds in the state of moist earth, and they may, therefore, be neglected) 31.25 + 20 = to 51.25 parts by volume of perfectly hardened cement. The specific gravity of the completely hardened cement was found to be 2.385. The cement has hardened under water, so that it cannot have lost any moisture, and the hardening process had been perfectly completed after one year. Therefore the cement took up all the water which it could hold in combination, and as it was a very finely ground cement, as customary nowadays, it is out of the question that there were grains left in it which were not completely hydrated. If you now divide 120 parts by weight of cment and combined water by 2.385, its specific gravity in the hydrated state, you obtain 50.31 parts by volume. Hence the combination with water did not cause an increase of volume, but apparently rather a slight condensation.

"The molecular change which has appeared, namely, the great brittleness, points to internal tensions. Whence can these come? If each particle be hydrated in its place, there is no reason for the appearance of stresses. We must, however, clearly keep in mind that the chief constituent in the cement, that is the lime, plays a most extraordinary part. The compounds of lime formed in the clinker are broken up in the process of hydration; a very large portion of the lime is set free, passes into solution and then crystallizes out in the mortar. We can even with the naked eye often observe these very large crystals of calcium hydrate. Where such crystals are eliminated, they act as wedges, which force their way into the mass, and in this manner very considerable stresses arise in the unyielding and highly inelastic substance. The higher the percentage of lime in the cement the greater the amount of crystallizing calcium hydrate eliminated in the hardening process. At the outset an increase of strength ensues in proportion to it; but there is a limit to this, and this limit may be exceeded; then disintegration takes place.

TABLE I.—ROTARY KILN PORTLAND CEMENT.

	Neat Coment			One-to-three Mortar		
Age.	Tensile Strength.	Compression Strength.	Cmp. ÷ Tns.	Tensile Strength.	Compression Strength.	Cmp. ÷ Tns.
3 days....	543	9,470	18	270	2,170	8
7 days....	957	13,270	14	364	4,370	12
28 days....	960	15,470	16	520	6,310	12
90 days....	891	16,230	18	561	6,860	12
1 year....	840	17,610	21	586	7,630	13
2 years...	860	17,230	20	590	7,870	13

Note—The neat cement samples were made up with 18 parts of water to 100 of cement, while the mortar samples were made of 100 parts cement, 300 parts standard sand and 32 parts water. All samples were kept in water. The cement was beaten into the molds in the state of damp earth.

"You will now ask, however, why in that case there should be a difference in the tensile strength and compression strength. The process ought to be the same in a briquette tested for tensile strength as in a cable submitted to compressive stress. I will now show you how, in my mind, this matter can be explained. Let us assume internal stresses to exist in our well-known tensile strength briquette and let us regard these as made up of three components, *a*, *b* and *c*, of which *a* is supposed to be effective in the direction of the longest axis of the briquette, and *b* and *c* at right angles to *a* and to each other. If we now try to pull the test piece we obviously need so much the less power the more the forces *a* are effective in the same direction; the two other components are of no importance for the tensile test.

"The elimination of lime increases as the hardening period of the cement continues, and in proportion to it these expansive internal stresses grow, and grow the more the higher the percentage of lime in the cement; or, in other words, the stronger the cement is; therefore this decrease in the tensile strength appears most distinctly in the cements richest in lime. As, however, the location where these calcium hydrate crystals shall be deposited in the hardening cement mass is not subject to any law, the most varied stresses may appear in the most different places in the test pieces. If these crystals were formed with special copiousness in the smallest section, the tensile strength would prove particularly low in this case; if, on the contrary, the zone of the least section had remained particularly free of calcium hydrate crystals, but some other part of the briquette were placed in a high condition of tension by many crystals, the test piece might break there much earlier than the cohesion in the least section would determine; this case will have occurred to you all from time to time.

"In testing for compression strength, however, conditions are quite different, perhaps just the opposite. Here the stresses *a* counteract the compressing force; the load is required to overcome these stresses, too, while the components *b* and *c* would probably remain indifferent also in this case. In fact I leave it an open question as to whether the tensions *b* and *c* do not co-operate to the same extent in overcoming the internal friction, as the forces *a* counteract the pressure; but even in this case the internal stresses would be without influence in the compression test, and this explains the different behavior of test pieces of neat cement under tensile and compression stress. The compression strength grows continually until the completion of the hardening process, but the tensile strength on the other hand decreases just in the strongest cements, namely, those richest in lime. In a sand mortar 1:3 there are sufficient porous spaces in which the calcium hydrate has adequate room for crystallizing out without giving rise to any noticeable internal stresses.

"Many years ago I observed the enormous variations in strength which cement test pieces show according to their conditions of moistness, and this has probably been noticed by all experimenters, because for this reason very definite rules are laid down as to how tests are to be carried out. Thus they direct that the test piece shall be taken direct from the water and immediately tested. Here I show you a cement, which molded in a plastic state, has hardened for 21 years in fresh water. Of this, I had made many hundreds of briquettes in the beginning of the eighties for future tests. I have now tested this cement after the lapse of twenty-one years, taking it direct from the water, and find it to have a tensile strength of 700 lbs. When I had allowed it to dry in the air for 6 hours before breaking it, it possessed 587 lbs. tensile strength; when it was dried in the air for 12 hours I found 619; when it had dried for a day in the air I obtained 584, for 2 days 580, and for 3 days 530. Dried 5 days in the air, it had 463, after one week's drying, 433, 2 weeks, 386, and 3 weeks, 336. Therefore, a cement which was taken from the water wet, and had hardened for 21 years no longer had one-half the strength when it had lain for 3 weeks in the room before being tested.

"When, however, the cement was dried for 24 hours at 110° C. it had 737 lbs. of tensile strength, when it was dried for 48 hours at 110° C. it showed 757, and after 72 hours 771 lbs., and after storing for three months in a room exposed to the air at 18° C., it had become perfectly dry and possessed 724 lbs.

"When this cement, having 724 lbs. of tensile strength, was immersed for only 3 hours in water, it showed 423 lbs. tensile strength, and after 6 hours in water 450. Now it was growing moist again; 12 hours in water 450, 24 hours in water, 483, and hereafter it again passes gradually into the strength it has when saturated with water.

"When it had been dried for 3 days at 110° C. it showed 771 lbs. of tensile strength, then after 12 hours' immersion in water only 471, 24 hours in water, 486; 48 hours in water, 490, and 72 hours in water, 637. Then it again approaches the saturated strength of 700 lbs.

"Two other cements, *B* and *C*, were dealt with in a similar way. The cement *B* showed, when water-saturated 733 lbs., the other, *C*, saturated, 671. But when dried in air for 3 weeks (which is an unfavorable time) *B*, 243, only 33 per cent. of the strength when saturated, and in the other case, *C*, 271 lbs.

"Neat cement moulded in damp state, which hardened for 4 years in fresh water when taken out of the water possessed 967 lbs.; when dried 5 days in the air only 350, and dried 4 months in air, 1,013.

"I now pass on to 1 part cement and 1 part sand. Here the same thing is repeated, though naturally not as distinctly: 1 part cement and 1 part sand saturated with water gave 721 lb., and dried 5 days in the air only 533 lb. You, therefore, see that in each case a cement in a dry condition has a materially lower strength, and this, of course, must be taken into consideration, both in testing and also in certain uses of cement.

"In tube testing, likewise, all these matters are of extreme importance. One part cement with 2 of sand showed after 4 years' hardening, gave 510 lbs. saturated; when dried 5 days in the air, 526; dried 4 weeks in the air, 630, and 4 months, 606. The more lean, that is to say, the drier, the cement becomes, the higher the strength found on drying. One part cement to 3 parts of sand, in a saturated condition, had 370 lbs.; dried 5 days in air, 437; dried 4 weeks in air, 560, and 4 months, 510 lbs. of tensile strength.

"Another cement which I have tested for 15 years for tensile strength was submitted in the tenth year to the following tests: Tested when taken from the water direct the tensile strength was 780 lbs.; when kept for 2 days in the air of the room, only 586; 7 days in the air, 467; 14 days, 520, and 21 days, 420, only one-half of the saturated briquette.

"For the compression strength of 1:3 mortar I again found something entirely different. The cement in the saturated condition gave 7,560 lb. compression strength; it had hardened for 245 days in fresh water. When kept for 3 days in the air of the room half of the inside was still moist; the inner core was distinguished by a darker color; but, in spite of this state, half dry and half moist, the strength had risen from 7,560 to 8,130 lb. This is in each case the average of 10 test cubes. After 5 days in the air it possessed only a moist core of one-fourth of its mass. The strength had increased to 8,330 lb. After 7 days there was left a moist core of only one-fifteenth of the volume; the strength was 8,910 lbs. After 14 days only a dark point was noticeable inside; the strength had risen to 9,370; after 21 days it was 9,600; after 28 days, 9,800, and after 60 days in the air it was 9,900 lbs. per square inch. Sand mortars, therefore, behave very favorably even in the ratio of 1:3, their strength increasing with the dryness.

"As an example of how far internal stresses can go and how even complete destruction may be wrought by them with increase of age, I submit a cement which has now hardened for more than 3 years in fresh water, and in sea water, and the testing of which is to extend over 5 years. In fresh water the tensile strengths during the first 2 years rose for the neat cement from 690 to 940 lbs.; after 3 years the tensile strength had receded to 840 lbs. The compression strengths had again constantly increased from 9,460 lbs. to 17,400 lbs. after 3 years.

"There would, of course, have been no object in ascertaining the 7, 28 and 90 days' strengths for sea water preservation, as the sea water must first be allowed time to act on the cement. As regards the sea water hardening, it was found that owing to substances eliminated in the mortar, as for instance owing to the sulphuric acid combinations formed, the tension had become so great even after one year, that the tensile strengths gave 240 to 1,030 lbs., and on the average, 970 lbs. The compressive tests gave concordant values averaging 13,400 lbs. per square inch. After 2 years the tensile strength for fresh water preservation was 940, and the compressive strength, 16,000, but for sea water preservation the tensile strength was 150 to 330, and the compressive strength, thoroughly concordant, 12,070. These figures after 3 years in fresh water were: Tensile, 840; compression, 17,400; but in sea water, 120 to 860 (one briquette still had 860 lbs.) and compression, 13,600 lbs. Here, therefore, you have very powerful internal tensions, and I anticipate that after 5 years the briquettes kept in sea water will be destroyed by expansion. After removing, by careful abrasion, the gray crust with which the test pieces kept in the sea water were covered themselves, the whole of the test pieces, up to the age of 3 years, on the most careful examination under the magnifying glass, appeared perfectly free from cracks and thoroughly sound.

"With 1:3 of sand the matter is, of course, quite different. With sand mortar there are sufficient pores present, and therefore the lime eliminated finds room everywhere; therefore, it is generally the cause of an increase in strength, but it is never injurious. With 1:3 of sand we have after 7 days, 264 lb. tensile strength; after 28 days, 330; after 90 days, 400; after 1 years, 480; after 2 years, 540, and after 3 years, 560. The compression strengths are 3,200, 4,900, 6,300, 8,300, 8,630, 8,800. In sea water this cement had a lower strength, but yet showed a normal increase, as in place of 480 lbs. in fresh water it had 370 after one year, and instead of 8,300 lb. compression strength, it showed 6,440. Therefore here likewise, as regards the compressive strength, tension arises, probably owing to the large mass of calcium-sulpho-aluminate and calcium sulphate, which may be eliminated in the mortar. The compressive strength had, however, not decreased.

"For 1:5 of sand the tensile strength is 110, 180, 200, 290, 320, 310 lbs., and the compression strengths, 870, 1,370, 1,900, 2,760, 2,810, 3,430 lb. In sea water after one year tensile strength, 260; after 2 years, 320 lb.; after 3 years, 325, that is to say, in no way less than in fresh water. With 5 parts of sand, therefore, there were still many more interstices and pores present, so that the salts eliminated in the interior of the cement could not give rise to any thrust, but instead even helped to increase the strength. The compression strengths were 2,160, 2,400 and 2,800.

Chicago, Ill. W. MICHAELIS, JR.

[Dr. Michaelis' translation of his father's paper was accompanied by a number of tables of tests, which have been omitted, as their important features are summarized in the text.]

A GAS-PUMPING PLANT of an unusual nature has been built at St. Gall, Switzerland. The city and its suburbs are located in a hilly country, the city being in a valley varying about 200 ft. in elevation, and the hills where gas must be delivered rise in one place over 600 ft. above the lowest point of the valley. The gas works, according to the "Journal of Gas Lighting," are on the Lake of Constance and are connected with the city by a 13¾-in. main 6.32 miles long. The difference in elevation between the works and the holder is 823 ft. In order to keep the size of the main as small as possible, the gas is forced through it by two rotary blowers, each of a capacity of 950 cu. ft. at a pressure of 17 in. and 1,870 cu. ft. at a pressure of 72½ in. They are driven by alternating-current motors.

CURRENT NEWS SUPPLEMENT

SEPTEMBER 23, 1905.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers. Secretary, Chas. Warren Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John St., New York.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk Street, Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O. Annual meeting, Boston, Sept. 25-29.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Paterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association.. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

American Water-Works Association.. Secretary, J. M. Diven, Charleston, S. C.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

National Association of Manufacturers of Sand-Lime Products. Secretary, H. A. Duerr, Wilmington, Del. Next meeting, Dec. 5-7, Detroit.

THE STIRLING-CAHALL CONSOLIDATION.

The most important announcement regarding power plant equipment made in a long time was issued last Saturday, when the consolidation of the water-tube boiler department of the Aultman & Taylor Machinery Co. and the Stirling Co. was officially reported. The details of the merger will probably not be worked out fully for a month or so, but it is understood that the new corporation which takes over the business of the companies mentioned will be known as the Stirling-Cahall Boiler Co. and will have a capitalization of about $4,500,000. The purpose of the combination of interests is to enable a single company to offer to a probable purchaser practically any style of water-tube boiler he wishes, and to guarantee that any type he may select will be made of the highest quality suitable for his purposes. To do this the new company will bring out a water-tube boiler of the water-leg type in addition to those already made by the Stirling and Aultman & Taylor shops.

The representatives of a company making all types of boilers will be free from the suspicion of advocating any one type when the best interests of the purchaser call for a different one, and the great fund of technical information collected by the two companies to this consolidation makes their advice on boiler selection of high value, even to experts in such subjects.

The Stirling boiler is the result of a development from a crude apparatus containing one mud drum, two steam drums and inclined connecting tubes. The object of this first design was to avoid the numerous joints and complicated headers of other water-tube boilers of that date. In the construction and installation of the early boilers of this type little attention was paid to details, and as a result the boiler did not enjoy a very good reputation, for attention to detail is absolutely essential for success in boiler making. The principle of the boiler was demonstrated to be a valuable one, however, and consequently its development along the lines of sound engineering practice was undertaken by men of ample capital, who have built up at Barberton, Ohio, an establishment occupying a 60-acre tract with 300,000 sq. ft. of floor space and over fifty independent buildings. These works were begun fifteen years ago and have been increased in capacity about tenfold since then. Many of the tools were designed by the company for the special purpose of boiler making, and their working has been most successful. Locomotive cranes, industrial railways and an exceptionally complete crane service facilitate the economical handling of the materials, and a central power station supplies electric current, pressure water and compressed air to the various buildings. Most of the tools are electrically driven. Ample facilities for inspection and testing of materials and boilers are at hand, and this feature of the works has been several times referred to in terms of high praise in reports by officers of the U. S. Navy. The company, it should be added, makes marine boilers under the Niclausse, Yarrow and Mosher patents, and has introduced special machinery of exceptional mechanical ingenuity for the production of such types with the highest practicable degree of workmanship.

The Cahall Sales Department has long enjoyed an extensive business in both vertical and horizontal water-tube boilers. The Cahall vertical type has been particularly favored in iron and steel plants, the most noted installation being at the Buffalo works of the Lackawanna Steel Co., fully illustrated in this journal two years ago. The type seems to be particularly well adapted to the use of blast furnace gas. A vertical boiler cannot be installed in many plants, however, on account of the head room required, and consequently the Cahall Sales Department has developed a horizontal water-tube boiler of the sectional header type. This contains a number of special features, and the makers have laid considerable stress on special grades of metal they have adopted for some of the details.

The company's manufacturing facilities at Mansfield were able, a few years ago, to turn out 400,000 h.p. of Cahall boilers and 200,000 h.p. of horizontal water-tube boilers per annum, and have been enlarged since then to meet the demand for these equipments. With the exception of the hydraulic and pneumatic tools in this plant, all the machinery is electrically driven.

An aggressive policy will be maintained in the export department through the foreign connections of the Stirling Co. in their offices in Johannesburg, Havana, Buenos Ayres, Yokohama and the Hawaiian Islands, as well as through their stock holdings in the Stirling Boiler Co., Ltd., of Edinburgh, which is interested in the water-tube boiler business of Great Britain and the Continent. It might be added as an indication of the favor in which the Stirling boiler is held, that the company's sales in eight years have increased nearly 800 per cent. As before stated details respecting the organization of the new company have not yet been worked out, but it may be safely assumed that the consolidation will be one of organization as well as of plants.

NEW ENGLAND WATER-WORKS ASSOCIATION.

The twenty-fourth annual convention of the New England Water Works Association, held Sept. 13, 14, 15 and 16, at the Murray Hill Hotel in New York City, was the most largely attended and undoubtedly one of the most interesting meetings in the history of the Association. The first session on Wednesday morning was opened by an address of welcome by Hon. John J. Delaney, corporation counsel of New York City. A communication from Mr. Charles A. Hague, chairman of the committee of the American Water Works Association on Standard Specifications for Cast Iron Pipe, inviting the Association to select a committee to act at a conference of committees on this question from various engineering organizations, was then read. After some discussion a committee, consisting of Messrs. Freeman C. Coffin, Dexter Brackett and F. F. Forbes, was appointed, these men having formed the committee which developed the Standard Specifications of the New England Water Works Association for Cast Iron Pipe.

Meters and Rates.—The report of the committee on Meter Rates was then taken up, and Mr. Frank E. Merrill, speaking for the committee, stated that the report was offered more as a suggestion than as a recommendation for a method of solving the problem. The report outlined two methods of assessing rates for supplying water through meters. First, the assessment method, and, second, the multiple minimum rate method. The assessment method as outlined is to assess a constant sum each year on each property based on the frontage on one street, and without regard to the amount of water used. In addition to the assessment, a certain price per 100 cu. ft., or 1,000 gal., will be charged for all water used through the meter. The multiple minimum rate method fixes rates to be paid for different kinds of fixtures in use, and a price per 100 cu. ft., or 1,000 gal. for all water used in excess of the amount paid for by the minimum rates at the schedule price. The first method is considered by the committee as the more scientific of the two and the one adopted for general and permanent use. The second method, while not considered so suitable for all conditions as the first, is held to be well adapted to securing a revenue similar to that obtained by fixture rates in works where the change is being made from fixture to meter rates, and where there is no data relating to the probable consumption with meters.

In the discussion of this report many widely differing opinions as to the feasibility of applying the suggestions in it were expressed and various counter suggestions made. Mr. Clemens Herschel expressed his opinion in a written communication to be in favor of selling water as gas and the electric fluid is sold, and at uniform rates to all consumers, with a pro rata refund of the profits, or excess profits, to the consumers at stated intervals. Mr. Allen Hazen considered the suggestions in the report to be an important step toward doing away with the objections to meters. He stated, however, that the cost of water might better be based on two things: the quantity of water used, and the length of the system and operating expenses, but that it would be difficult to accept any general method since so much depended on local conditions.

The present status of metering in Cleveland where 40,000 meters have already been installed and the remaining service connections are being equipped with meters as rapidly as possible, was referred to by Mr. Edward W. Bemis. He has had a very careful analysis made of over 30,000 water bills based on meter readings and found that in 12,000 residences only about 2,000 cu. ft. is used on the average every 6 mo. Two minimum rates have been established in Cleveland for connections of this class, to avoid revenues dropping on the introduction of meters. A uniform rate of 40 cents per 1,000 cu. ft. is charged for water in excess of the amount fixed by the minimum and the minimum rates are made so that no gain is made by the consumer in using less water than is sufficient for all legitimate purposes, thereby removing the principal objection of physicians to meters. At the same time the rates are low enough to permit any family using water at a less cost than it could be obtained elsewhere.

Fire Service.—A meter for fire-service connections, which has been developed in the experimental laboratory of the National Fire Protection Association, was described at the afternoon session in a paper by Mr. E. V. French of that association. The meter consists of a weighted check valve with a metered by-pass, which has an opening proportional in cross section to that of the check valve. The ordinary flow goes through the by-pass and the check-valve remains closed until the draft on the connection becomes equal to a predetermined amount, when the check valve opens. A system of levers attached to the weight on the check valve regulates the action of the by-pass meter with the raising of the check-valve clapper so that the multiplying factor is automatically correct and a true reading is given for all flows. Accurate results have been obtained in testing this meter and since it will measure a flow as small as 4 to 5 gal. a minute, Mr. French considers it sufficiently accurate for all practical purposes. Those who had seen the meter in operation were of the opinion that it successfully overcomes the objections that have been raised so strongly against meters on fire-service connections, and since no mechanical difficulties are presented in its construction, it ought to be a step in the right direction toward securing a marketable device of this character.

The regulations governing private fire connections with the mains of the water works in Newark, N. J., were briefly stated by Mr. Morris R. Sherrerd in discussing the report of the committee on "Private Fire Services." The insurance companies, he feels, are often unreasonable in their demands as to the size of these services and not infrequently look more to the protection of the particular risk than to the fire hazard of the community. A regulation is made in Newark that no connections larger than 6 in. shall be made to the mains of the new high service system, described in The Engineering Record, May 6, 1905, and in case more protection is required in a building than is afforded by a connection of this size a second connection is permitted, but it must be in a part of the structure distant from the first one.

The report of the committee on "Uniformity of Hose and Hydrant Threads," which was received on Thursday morning, recommended that the formula of the National Fire Protection Association, which has been adopted as a standard by practically all of the organizations interested in the subject, be adopted as the standard of the

New England Water Works Association. This formula includes among other requirements 7½ threads to the inch on 2½-in. couplings.

Swivel couplings cut with this number of threads will make a satisfactory connection to the male ends of couplings cut to 7 and 8 threads, where the outside diameter of each is 3 1-16 in. To accommodate the swivel, female, end of the 7 and 8-thread coupling to that of the 7½-in. thread one, an adapter would have to be used, but this, the committee considers, would mean limited expense after the adoption of a standard. The association adopted the formula as recommended in the report, after some discussion. A motion was then passed to appoint a committee to inquire into the question of a standard size and shape of nut for hydrants and also the direction in which the hydrant should open.

The use of the card system was referred to Thursday morning in the discussion of a paper on "Water Works Accounting," by Mr. John F. J. Mulhall. Cards are used extensively and with a great deal of satisfaction in keeping the records of the meter department of the Cleveland water works. In speaking of their use in this connection, Mr. Edward W. Bemis said that they were specially valuable in this department on account of the rapidity with which meters are being installed. The question of time in auditing accounts, the liability of loss of cards, and the higher standard afforded bound books, or even loose-leaf ledgers are held by Mr. Mulhall to be strong arguments in favor of book accounts for permanent financial records.

Water Purification.—A paper on the water-softening plant at Oberlin, O., by Mr. W. B. Gerrish, brought forth considerable comment on the saving of soap, due to the operation of such a plant, in a community having an extremely hard water supply. Mr. Gerrish said no data regarding the actual saving of soap had been obtained on a large scale, but the reduction in the amount of soap used in private families was evident and that the difference in the wear on clothing and the effect of the water on the skin were particularly noticeable.

The cause of the marked difference in the severity of typhoid fever cases under practically parallel conditions after infection was attributed in a paper by Dr. W. P. Mason to be due to a large extent to the character of the water carriage of the infecting bacteria. The germs in the water from wells usually cause much more severe cases than those in water from streams and this is held to be due to the conditions governing the use of well water, which generally permit of a shorter period of time elapsing between the entrance of the polluting matter and the use of the water than in river supplies. The adverse conditions to the growth of typhoid germs during river carriage, furthermore, supply abundant opportunity for these germs to either lose a portion of their virulence or die. Dr. Mason cited considerable data to substantiate these claims and in the discussion which followed, Mr. M. N. Baker emphasized the incompleteness of typhoid statistics and the need of bringing pressure to bear to get more complete and vital statistics regarding typhoid and that the cases of diarrheal diseases should also be included, since their origin is undoubtedly at least in relation to the origin of typhoid. This last point of Mr. Baker's was brought out in the remainder of the discussion, several instances being cited where epidemics of intestinal diseases had preceded epidemics of typhoid fever.

A review of the relation of copper sulphate to water supply matters, which occupied the morning session on Friday, furnished the most interesting material of the meeting. A statement of the general problem, with special reference to the use of copper sulphate as an algicide, was first made by Dr. George T. Moore, who in connection with Dr. Karl F. Kellerman, has done so much practical work along this line in the U. S. Department of Agriculture. This method of treating water supplies is not a shotgun method, and Dr. Moore stated that it is imperative that the form of algæ be known to determine the amount of copper necessary, since the susceptibility of different forms to the copper sulphate varies greatly. The amount of copper required to produce results in practice is not nearly so great as in laboratory tests and it will be necessary to reduce the requirements determined in some theoretical tests. The original projectors did not contemplate, Dr. Moore says, that this method should replace any other method of treating water, but should be used as an adjunct to the methods already in use and to purify water supplies in extreme cases where the dangerous conditions of pollution would not occur again.

The use of copper sulphate to guard against typhoid fever epidemics coming from unfiltered surface water supplies was discussed by Dr. W. P. Mason, who considers that the continuous dosing necessary to a permanent cure of the typhoid evil is dangerous. An occasional dose of copper sulphate such as is required to clear out a growth of algæ is permissible, he believes, and the use of copper in epidemics of water-borne diseases may also be justified.

A number of experiments made in the Mt. Prospect laboratory of the Brooklyn, N. Y., water department to determine the destruction of typhoid fever germs by copper sulphate appear to demonstrate that one part of copper sulphate to 2,000,000 parts of water containing ordinary laboratory cultures of typhoid bacteria rendered the water sterile. A strength of one part copper sulphate to 50,000 parts of water was required, however, Mr. D. D. Jackson who was is charge of the experiments stated, to render sterile water containing virulent typhoid bacteria from a patient who had just died of the disease.

A paper concerning the behavior and uses of copper sulphate in the purification of hard and turbid waters, by Mr. J. W. Ellms, gave the results of a considerable amount of work that has been undertaken in Cincinnati to determine the applicability of this method of treatment to water supplies in the Middle West. The experiments that have been made at Columbus, O., on the application of copper sulphate to the effluents of coarse-grain sewage filters were described in a paper by Mr. G. A. Johnson, who considers that one part copper sulphate in 1,000,000 parts of effluent from a coarse-grain sewage filter has been found to give effective results, if the effluent is stored for several hours after treatment.

Tests made at the Lawrence, Mass., experiment station to determine the value of copper sulphate as an aid to filters in the purification of polluted water were said to have shown poorer results when using copper sulphate than when operating the same filter without the use of copper sulphate.

An accumulation of copper on the sand in the filter took place which would, it is considered, reduce the efficiency of the filter very greatly if the copper in the form in which it remains on the sand has any strength as a bactericide. The Massachusetts State Board of Health has, however, achieved fairly uniform success in treating reservoirs with copper sulphate to rid them of algæ growths, the amount of copper used having varied from one part in 700,000 parts of water to one part in 32,000,000 parts of water, depending on the form of algæ and other conditions. The difference in the effects on fish is very noticeable, Mr. X. H. Goodenough said, in speaking of this work, fish in stored water being much less susceptible to copper than those in natural ponds, although where fish had been killed it was believed to be due in a measure to the unequal diffusion of the copper by the method of application used.

The toxicological aspects of the copper sulphate treatment were discussed by Prof. Herbert E. Smith, who is of the opinion that small doses extended over a long time do not produce deleterious results and that there is no danger from the amount of copper sulphate necessary to rid water supplies of algæ forms. The use of metallic copper for the purification of drinking water and the effect of water treated with copper on the human system were taken up in a paper by Prof. Henry Kraemer, in which it was also concluded that harmful effects of the copper under the conditions accompanying its use in water purification are lacking.

The methods of estimating stream flow in New England as followed by the U. S. Geological Survey were outlined in a paper illustrated by lantern slides by Mr. H. K. Barrows at the Friday evening session. The water supplies of the New York metropolitan district, with special reference to their purification, were described briefly in another illustrated paper by Mr. Geo. C. Whipple the same evening. A large amount of general information was included in his paper and the illustrations were particularly indicative of the wide range of methods of water purification in use in this district.

The social features of the convention consisted in a theater party on Wednesday evening, a trip around New York Harbor and thence to Coney Island on Thursday afternoon and evening, a trip in the Subway and a visit to the Subway power house on Friday afternoon and an all-day trip to the Croton Dam on Saturday. A large number of water works and manufacturing plants in the vicinity were also thrown open to the members. In point of attendance the convention was the largest ever held, over 600 members and guests having registered as being present during the sessions.

Julian Scholl & Co., 126 Liberty St., New York, have lately issued two pamphlets of much interest to contractors. The first describes the "Universal" two-wheel steam roller, made in nine sizes from 3 to 12 tons and possessing many unusual features. The second pamphlet describes the "Reliance" steel stone crushers, and the various elevators, bins, screens and other equipment necessary for large and small rock crushing plants.

THE NEW YORK & LONG ISLAND R. R. SUBAQUEOUS TUNNELS.

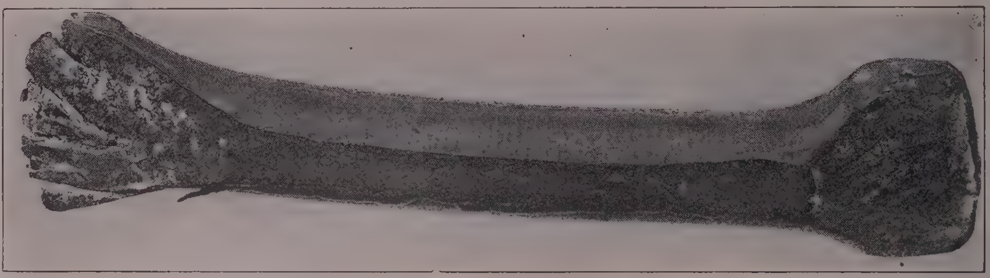
The two tunnels of the New York & Long Island R. R. under the East River between New York and Long Island City bring the total number of subaqueous tunnels entering Manhattan Island up to fourteen. The new railroad will connect with the present New York subway system at Third Ave. and Forty-second St., at which point a large subterranean station will be built about 80 ft. below the subway grade. Escalators will carry passengers from Long Island to the subway station and the surface. At the eastern terminus, connection will be made with surface lines on Long Island.

The Degnon Contracting Co. are contractors for the new tunnels and have just placed one of the largest machinery orders of recent times with the Ingersoll-Sergeant Drill Co., of New York.

This includes fourteen air compressors, of two different types. Eight are of duplex compound class HC pattern with steam cylinders 16 and 28 in. in diameter, air cylinders 25¼ and 16¼ in. in diameter, and a stroke of 16 in. Each unit has a free air capacity of 1,205 cu. ft. per minute. The other six are of straight-line class A type, with a 24-in. steam cylinder, 26¼-in. air cylinder and a stroke of 30 in. The capacity of each is 1,444 cu. ft. per minute. The aggregate free air capacity of the fourteen compressors is 18,304 cu. ft. per minute.

The shield method will be used in driving these tunnels. The straight-line compressors will furnish air to the headings for keeping out the water, and will also supply intake air to the other machines. The compound units, drawing their air at the discharge pressure of the low-pressure machines, will furnish air at high pressure to the rock drills and other machinery in the tunnel bores.

As at present planned, the work of driving these tunnels contemplates three shafts. One will be at the Long Island terminus, another at Forty-second St. and the river front in New York, and the third will be on Man-o-War's Reef in the East River, and some interesting work will be done here in providing room for a power plant. Ultimately it is expected that quite a large island will be made here with the rock removed from the tunnel. From this central shaft, the bores will be driven in both directions. The fourteen compressors will be distributed among the three plants. This last order makes a total of 54 Ingersoll-Sergeant air compressors in use or contracted for on subaqueous tunnels entering New York City. The aggregate free air capacity of these machines is 138,426 cu. ft. per minute, and the pressures delivered range from 30 to 150 lb.



IRON BAR, AFTER PASSING THROUGH KENT MILL.

GRINDING A CROWBAR

The accompanying illustration of what happened to a piece of a crowbar that entered the midst of a Kent mill while in action affords some idea of the reason for giving great strength to such machinery. This piece of iron was 9 in. long and 1¼ thick. It entered chisel end first and emerged with a sharp bend, only partially shown in the illustration, two well-flattened ends, and considerable squaring on the sides. This happened at Miller's Fertilizer Works in Baltimore, and after it was all over it was found that the mill had not been injured in any way.

This result was doubtless due to the special construction of the mill. It has a ring die having its inside surface concave so that at the deepest place about an inch thickness of material to be ground can be retained. This ring is carried on rollers placed within it, each provided with powerful adjustable springs. By this construction none of the shock of grinding is communicated directly to the shafts of the rollers and the pressure they exert on the ring is equalized, in a sense. The pressure between the upper roller and the ring is utilized in driving the latter, the roller acting as a driving wheel for this purpose. The shafts of the rollers are themselves mounted in spring-held boxes on the casing of the mill, so that very little jar is communicated to it. A certain amount of longitudinal play is permitted these shafts, just as in the boxes of railway cars, for such play has been found necessary for the most satisfactory operation of the machine.

THE CENTRAL STATES WATER-WORKS ASSOCIATION.

The ninth annual convention of the Central States Water-Works Association at Columbus last week was not well attended on account of a new State law, which received considerable attention during the proceedings. This law is a part of the Ohio Municipal Code, which apparently contains a number of defects on account of the hurried manner in which its final form was drawn up. The purpose of the Code is to give all cities in the State a uniform organization and system of administration, so that a comparison of the different results attained in various cities will give useful information. One of the features of the Code is a provision under which municipalities are forbidden to pay the expenses of their officers who attend meetings for the express purpose of discussing municipal matters, like those of the Central States Water-Works Association, the Association of Boards of Public Service and the like. The manifest lack of harmony between the spirit of the Code and this prohibition has led a number of organizations to take up the matter of legislative relief with the Attorney General of Ohio, who has promised to assist in securing the passage of such a measure.

The choice of Columbus for a convention city was a happy one on account of the large amount of work now under way or projected here. Street improvements now in progress or ordered since January 1 are estimated to cost $528,344, and the use of brick in such work is particularly noticeable. Bids will shortly be asked for sewage purification works for a nominal flow of 20,000,000 gal. The plans contemplate septic tanks of about 8,000,000 gal. capacity, and ten acres of sprinkling filters, designed for a rate of 2,000,000 gal. per acre. The new dam across the Scioto River was described in this journal a short time ago and the water purifying and softening plant of a unique character was shortly put under contract. The municipal electric lighting station, costing $500,000, has a capacity of 2,000 arc lamps and is a steam-turbine station. The cost of light per lamp on an all-night schedule was stated at the convention to be $60; this is on the basis of 4 per cent. interest on the investment and 8 per cent. for depreciation. These city undertakings were described in a general way by Mr. Julian Griggs, city engineer, and were afterwards visited.

The first paper was by Mr. C. W. Wiles, of Delaware, and was on the private and public ownership of waterworks. In a general way it brought out a number of features in which the present obligations on public works in the way of supplying water for nothing worked to the disadvantage of consumers and tended to make the cost of the service higher than that charged by private companies. The author acknowledged, however, that with the many advantages enjoyed by a municipal department, such as a lower rate of interest on bonds, exemption from taxes and, in some cities, a frontage tax on unimproved property, with equally careful and economical management, it is possible to supply water at a lower cost than can be done by a private company. The paper brought out an animated discussion, particularly on the subject of keeping down the cost of the water supplied by municipal plants for public uses in Ohio, where no charges can be made for such service, although the legal advisers of some cities have found ways of getting around this law. Mr. Wiles pointed out that the expense of furnishing water to public departments was often very large and unless the works were credited with the cost of this water the consumers were made to pay for services which were really of a public nature and should be paid for by general taxation.

The second paper was by Mr. W. H. Ferguson, of Springfield, O., and was a discussion of the necessity of metering private fire services. In his opinion the returns for such services were usually but a small part of what they should be, while the temptation to take water from them for other than fire purposes was often too great to be resisted. In the discussion of the paper Mr. Latta indulged in such warm comments on the uses made of fire protection lines that there was some chance of needing help from the neighboring meeting of Ohio Fire Chiefs to put out the flames. He seemed to have had a troubled experience with fire lines, and told about the variety of ways in which people tried to open them surreptitiously. The discussion was a full one and was particularly instructive as showing the difficulties with meters in places where the water carries much sediment.

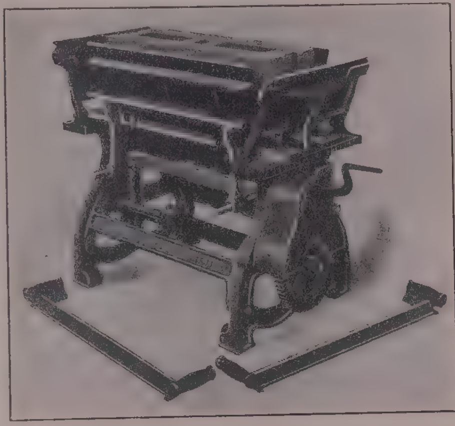
The third paper was by Mr. John Langan, of Tipton, Ind., and explained his experience in lifting water from deep wells by the use of compressed air. Four years ago he read a paper on the same subject before the Association, which attracted much attention. Since then he has been making a number of experiments with different types of nozzles, and succeeded in this way in bringing up the yield of a 6-in. well 280 ft. deep to about 40 gal. per minute. He was unable to increase this discharge until he adopted a Harris apparatus. With a depth of 138 ft. to the suction inlet, a ¾-in. air line and 45-lb. working air pressure, he has since been able to maintain a steady discharge of 150 gal. per minute from this well. This device was explained at some length by the inventor, Mr. Walter B. Harris, of Indianapolis.

In the fourth paper of the convention, Mr. A. L. Holmes, of Grand Rapids, discussed the subject of water waste, presenting some statistics showing the reduction that has been due to the introduction of meters. In his opinion the business-like way of cutting off waste was to require each consumer to pay by meter, thus making him an inspector of his own service and insuring to the municipality a reasonable revenue for the service furnished. In one case, a small city of about 6,000 population, there were 516 taps in use in 1901. None of these was metered and nearly 33,000,000 gal. of water were pumped. In 1904, after meters were put on all the taps, which had increased in number to 580, the pumpage was only 9,500,000 gal.

The next meeting will be held at Cincinnati. The officers elected for the ensuing year are: President, C. J. Thuman, Evansville, Ind.; Vice-President, A. W. Inman, Massillon, O.; John Langan, Tipton, Ind.; W. H. Glore, Covington, Ky.; T. H. Morton, Nashville, Tenn.; A. L. Holmes, Grand Rapids, Mich.; W. Schwertfeger, Wheeling, W. Va.; Secretary, Wm. Allen Veach, Newark, O.; Treasurer, Charles E. Rowe, Dayton, O.; Executive Committee, A. H. McAlpine, Columbus; T. R. Cook, Toledo, O.; C. W. Wiles, Delaware, O.

A NEW HOLLOW BLOCK MACHINE.

The original inventor of hollow concrete block machinery, Mr. Harmon S. Palmer, of Washington, D. C., has recently made a number of improvements in the apparatus he manufactures, embodying the good features of the old machine with new details which the astonishing development of hollow block construction has shown to be desirable. In designing the improved model, two objects were kept in view, to furnish an apparatus which would turn out dense, clean-cut blocks when properly used and to make a machine which would accomplish this result with minimum expense. The machine is a tool and its builder has worked to make it a labor-saving and expense-saving tool. Accordingly attention has been paid to having the machine at the right height for tamping most easily, and at the same time it is arranged so that the tampers can work equally well on any side. The adjustment for making blocks of different widths is very simple, and when the machine is opened the block is ready to be picked up with the hook, without sliding or moving it in any way. The cores can be changed in a minute, the sides in half a minute and a plate for thin blocks can be adjusted in two minutes. Economy of maintenance has been safeguarded by strong construction and by covering all working parts. It is an axiom in cement plants that all machinery must be made many times heavier than theory calls for in order to resist the rapid wear which takes place wherever cement dust can lodge. In a block machine sand is present to add to the trouble caused by cement, and the desirability of protecting the wearing parts is emphasized accordingly.



NEW CONCRETE BLOCK MACHINE.

In operating features the machine is characterized by the principles which the inventor has long advocated as necessary for producing sound, clean blocks. These are two well known to need detailed mention here. The illustration shows the machine partly open. By turning the crank the cores are lowered and the sides unlocked. The latter fall outward into a horizontal position from their own weight, but are counterbalanced so that there is no jar as they drop back. In this position they can be cleaned with a brush and oil. This cleaning should not be overlooked, because these parts give shape to the block and any neglect of them will cause trouble, as it will in all machines. The top of the block, after the mold is tamped full, is struck over by the planed bottom surface of the adjustable sliding hopper fitted to the solid inclined ends. The cores are beneath the block, out of the way, when the machine is opened. They are tapered and this form is claimed by Mr. Palmer to be of much help in giving the sides of the block perfect impressions from the mold and also in producing hard, waterproof concrete.

The machine makes hollow blocks with sides 2 to 6 in. thick and of different lengths, while attachments can be furnished for making blocks of the size of common brick, and angle blocks for bay windows. The inventor's practical experience as a builder and contractor has led him to pay special attention to designing an apparatus which will turn out really useful blocks, and the machine will be introduced to put a "practical building material in the hands of the common people."

STORAGE BATTERIES IN THE ELECTRIFICATION OF STEAM RAILROADS.

The contracts recently closed by the Electric Storage Battery Co. for storage battery installations for the Long Island division of the Pennsylvania R. R. and the New York Central & Hudson River R. R. are noteworthy for several reasons. The conditions to be met in heavy railroad service are particularly adapted to permit the realization of the peculiar advantages offered by storage batteries. The loads falling on the various distributing centers are exceedingly intermittent in character and even at the main generating station are of a widely fluctuating nature. This must necessarily be so since the heavier the train units the further apart they are spaced in time, and even if the lighter trains are run at frequent intervals for strictly suburban traffic the loads created by these will be of minor importance as compared with those due to the heavy through express trains hauled by electric locomotives of very large capacity adapted for high rates of acceleration. These trains, while they may leave the terminal stations at predetermined hours, will be spaced by considerable intervals of time and the hour of their arrival will always be subject to delay and uncertainty as a result of any derangement of schedule at any part of the road. The result is a load of exceedingly uncertain character whose maximum will be many times its average.

The storage battery affords continuity in three different ways: First, by removing the excessive overloads, it renders derangement of electrical machinery less likely to occur. Second, by permitting any portion of the electrical apparatus to be shut down instantly as soon as signs of trouble appear, the battery may prevent the development of more serious trouble which would result if the apparatus should continue to be operated; thus limiting the difficulty to that which can be repaired in a few moments. Third, in case of a more serious breakdown, whether in sub-station apparatus, transmission lines or generating units, the battery will keep the trains in motion until additional apparatus can be put into operation.

One of the first railroads to equip a portion of its lines for heavy electric locomotive traction (as distinguished from individually equipped cars for suburban or interurban service) was the Baltimore & Ohio R. R. In 1895, a section about 3½ miles in length through the tunnel under the city of Baltimore was equipped with third rail re-enforced with heavy copper cables, and electric locomotives were put in service, designed for hauling the heaviest trains including their steam locomotives, which were not uncoupled. The power house was located at one end of the electrified section. After the system had been in operation for some time, the severe fluctuations of load on the power house and wide variations of voltage on the line furnished the most convincing arguments in favor of a storage battery, and in the fall of 1900 a contract was closed with the Electric Storage Battery Co. covering the installation of 320 cells, having a capacity of 1,500 amperes for one hour. This battery was installed in a battery house located at the Mt. Royal Passenger Station, near the middle of the electrified section, and operated as a line battery, relieving the power house of the load fluctuations and producing satisfactory line voltage. Later, a second series of cells was installed in parallel with the first, and of nearly equal capacity, to provide for heavier peak conditions. The results obtained from the operation of this plant have been most satisfactory in every way.

It is worthy of note that in the two important steam railroad electrifications now in progress in the vicinity of New York (the Long Island division of the Pennsylvania R. R. and the N. Y. Central & Hudson River R. R.) storage batteries have been included as a part of the original equipment, the substations and generating plants being designed with reference to battery installations, thus affording a very much better opportunity to realize their full benefit than would be the case if they had been installed as an afterthought to meet conditions which had not been fully anticipated.

The lines on Long Island, which constitute an extension of the Pennsylvania R. R. tunnel system under Manhattan, obtain current from a generating station at Long Island City, from which high-tension alternating current is transmitted to the several rotary substations. The first of these substations to be put into operation is that at Hammel, where two 1,000-kw. rotary converters have been installed, operating at 600 volts, and a battery of chloride accumulators having a capacity of 3,200 amperes for one hour, and especially designed for the heavy momentary overloads called for in this class of service.

Two boosters have been installed, operating in parallel, each having a capacity corresponding to half the maximum output of the battery. These boosters are controlled by the Electric Storage Battery Co.'s recently developed carbon regulator, which automatically causes the battery to charge and discharge in response to fluctuations of load, and permits of convenient adjustment for any desired division of load between the battery and the rotaries. The battery thus relieves the substation and the power house of the sudden excessive demands for accelerating heavy trains, as well as the more prolonged peaks due to congestion of traffic such as frequently occur during the summer months and the racing season.

The lines of the New York Central which are now being equipped electrically extend from the Grand Central Depot in New York City north along the Hudson River to Croton, a distance of 35 miles, and will include also the Harlem Division from its junction with the main line at Mott Haven to White Plains, making a total distance of 55 miles. All passenger trains in this district will be electrically operated. The heavier through and express trains will be handled by electric locomotives which will be substituted for the steam locomotives at the northern limit of the electric district, while the local and suburban service will be handled by motor cars and trailers in trains with multiple unit control. The third-rail system has been adopted, power being distributed at 666 volts direct current from eight substations.

The elements in these battery installations will be made up of plates specially developed for heavy railroad work and high discharge rates. The plants are designed to take full advantage of such rates, and in cases of emergency it is expected that momentary discharges up to three times the one-hour rate may be called for. The 11 boosters (two operating in parallel at each of the three larger plants and one at each of the others) will be identical, and of capacity corresponding to the maximum discharge rates of the batteries. Each booster will consist of a direct-current generator direct-connected to a three-phase induction motor, wound for the same alternating-current voltage as the rotaries, but connected to a special set of static transformers. The booster field will be separately excited by a direct-current motor-driven exciter. Two such exciter sets are to be installed in each substation, each having sufficient capacity to control the fields of two boosters operating in parallel. The fields of the exciter will be controlled by the carbon regulator.

Power will be generated at two distinct generating stations, one located at Yonkers and one at Port Morris and transmitted at 11,000 volts, three-phase, over high-tension lines so arranged that any substation may be supplied from either power station. At each power station are being installed three 5,000-kw. turbo-alternators, either plant alone having sufficient capacity to operate the entire system in conjunction with the substation batteries during maximum estimated load conditions, should this be necessary.

The heavy electric locomotives which are being built for this service are designed for a current demand which may reach 4,000 amperes during acceleration. Two of these may be coupled to one of the heavy Western expresses; thus a substation whose average output may not exceed 1,000 kw. for many hours is liable to be called on for a momentary output of 5,000 kw., equal to the full-load capacity of one of the power-house units. To relieve the substations and power houses of these excessive overloads was one of the objects of the battery installations, which thereby permitted a considerable reduction in the rotary capacity which would otherwise have been required and likewise eliminated one 5,000-kw. unit at each power house. This saving in apparatus and the corresponding reduction in transmission copper very nearly offset the cost of the batteries.

The various advantages derived from the operation of these batteries are, therefore, secured with practically no increase in investment or operating expenses. Among these advantages, the feature of reserve capacity and insurance against interruption of service was one of the most important considerations that led the management of the New York Central & Hudson River R. R. and the commission of consulting engineers to install these batteries. It is estimated that the total battery capacity is sufficient to carry the entire load on the system for a period of about an hour during average conditions of traffic or for half an hour at the time of maximum schedule. Provision has been made for future increase of capacity by providing tanks somewhat larger than required for the number of plates first installed.

Wire rope tramways have become an important means of handling materials over any kind of country and the new catalogue of them issued by the A. Leschen & Sons Rope Co., of St. Louis, illustrates many noteworthy installations. Naturally enough special stress is laid on "automatic aerial" and "friction grip" types, which are described thoroughly, but a full explanation is also given of many other varieties of such outfits. The suggestions concerning the special field of each type will prove useful to many engineers.

A LARGE SAND-LIME BRICK PLANT.

One of the most important events which has happened recently in the sand-lime brick industry in this country is the formation of the New York Granite Brick Co. by the H. Huennekes Co., of 114 Liberty St., New York City, and some of the most prominent engineers and architects in this country. There are interested in this company besides the officers of the H. Huennekes Co., William Barclay Parsons, St. John Clarke, engineer of the new tunnel and subway being built from 42d St. to Long Island; C. S. L. F. Deyo, chief engineer of operation of the subways in New York City; Mr. Ross, of the firm of Eidlitz & Ross, well-known contractors in steel work; John Wilbur, President of the Salem Nail Co., a concern of over 40 years business standing; W. S. Bailey, one of the largest contractors for building material in New York, and a few other prominent architects.

This company has contractod with the H. Huennekes Co. for the entire equipment of a factory to have an actual capacity of 100,000 bricks per day of 10 hours. The factory site has been selected, and will be located at South River, near Salemville, and directly in the heart of the brick district. The officers of this company are composed of the gentlemen named above and in addition thereto, L. F. Kwiatkowski, President, and F. A. Crandall, Vice-President of the H. Huennekes Co. This factory will be erected during the present fall and winter and will be ready for operation the first month of the coming year, beginning immediately to turn out small bricks for building operations next season.

MUNICIPAL RAILWAY TROUBLES IN SHEFFIELD, ENGLAND.

An account of the troubles of the city of Sheffield, England, with its municipal street railway has been supplied by U. S. Consul Daniels at that city to the Bureau of Commerce and Labor. The portion of his report that has been made public reads as follows:

The city of Sheffield, in the management of its electric tramway system, finds itself confronted with a condition that some of the more far-seeing members of the city council (notably Sir Joseph Jonas, the lord mayor) have insisted has existed for some time, and that condition is, despite the fact that the system has been operated at an apparent profit, while furnishing cheaper transportation than any system in the United Kingdom, due to a failure to properly charge off a reasonable amount yearly for depreciation of plant. This failure brings them face to face with the necessity of adjusting and raising the fares or operating the system at a loss, possibly, or, at any rate, no profit.

The report of the tramways committee for the past year shows the following condition: The mileage run was, 1901, 2,315,347 miles; 1902, 3,791,993; 1903, 4,926,083; 1904, 5,768,231; 1905, 6,049,899. The passengers carried rose from 61,450,993 in 1904 to 63,952,283, and the revenue from all sources from $1,130,738 to $1,170,713, an increase of 2,501,290 in number and $39,975 in car mileage, 281,668 greater than that of the previous year. In 1901 each car earned on an average 27 cents per car-mile run and the average fare per passenger was 1.8 cents. The figures for the following years were: 1902, 23½ cents and 1.8 cents; 1903, 20½ cents and 1.8 cents; 1904, 19 cents and 1.8 cents; 1905, 19 cents and 1.8 cents. If the fares per passenger in 1905 had been the same as in 1901, the revenue would have increased by the sum of $37,472. The average fare per passenger in Manchester was 2.38 cents; Bradford, 2.26 cents, and Liverpool, 2.22 cents.

The average working expenses per car mile in 1901 were 14.5 cents; in 1904 they had gone down to 13 cents, while in 1905 they had been further reduced to 12.8 cents, which is the lowest in the history of the undertaking. Had the working expenses in 1905 been the same as in 1901 the charges would have been increased by $153,095.

The net profit in 1904 was $132,412 and in 1905 $84,317, or $48,665 less. This decrease was not due to cost of management being excessive, because the percentage of that cost was less than ever before; nor was it due to the cost of production of energy, for that cost in Sheffield is among the lowest in the country. The decreased profit was in the first instance attributable to the increased charges in 1905 over 1904, without any corresponding decerase in revenue. Salaries and office expenses previously charged to capital are now transferred to revenue, and represent $10,123; rates and taxes caused by reassessment, $17,817; repairs to cars, permanent way, and power station, $37,536; interest on loans, $35,132; installments for sinking fund, $22,193, making the total increased charges over the previous year $122,801. To be deducted from that were $10,738 decrease in traffic expenses, $2,655 saved in insurance, $12,348 decrease in power expense, a total of $25,741.

A comparison of the Sheffield tramway undertaking with that of Leeds is given. Leeds has the advantage in the matter of gradients. The population of Leeds is 450,142; Sheffield, 432,940. Car miles run: Leeds, 7,051,823; Sheffield, 6,049,899. Receipts: Leeds, $1,432,347; Sheffield, $1,170,709. Expenditures: Leeds, $784,951; Sheffield, $794,616. Passengers carried: Leeds, 64,223,660; Sheffield, 63,952,283. Average fare: Leeds, 2.19 cents; Sheffield, 1.8 cents. The average distance traveled in Leeds for 2 cents was 1.57 miles; in Sheffield, 2.48, or nearly a mile more. The lord mayor is authority for the statement that Sheffield fares are 17 per cent cheaper than the next cheapest in the country. If they were based upon Leeds fares, Sheffield would have an increased yearly revenue of $253,058, provided the same number of persons traveled and the Leeds rates were adopted here.

The corporation is constantly besieged with applications for extensions of the tramway serivce to outlying districts. This is felt to be a policy that ought to be adhered to, but it is apparent to all that no further extensions of the service can be made without providing in some way for increased revenue. It is also conceded now that the past policy of the tramway management has been wrong, in that they have not allowed enough for depreciation and renewals. The city of Glasgow sets aside 6 cents per mile for depreciation; Manchester allows 2.4 cents, and Liverpool 2 cents. Sheffield is supposed to allow 2 cents, but if it had the account, instead of showing a surplus of $84,321, would have shown a deficit of $38,348.

There the matter stands at present. The only remedy in sight appears to be to raise the rate of fare, and that no member of the city council seems to be ready to advocate.

A NEW DUMPING WAGON FOR CONTRACTORS

A new type of dumping wagon for contractors' purposes has been under test for some time by the National Drill & Mfg. Co., Trinity Building, New York. It is of the bottom dumping type, the novelty lying in the fact that the two doors are not hung by fixed hinges, but are attached by means of loops operating on vertical slide guides on the outside of the box. The chains which hold the centers of the doors in position are not long enough to allow the latter to come into contact with the ground. The result is that the pressure of the load in falling, after the chains have been released, forces the doors up on the outside of the box, lifting them clear of the dump and preventing the possibility of stalling the wagon. After the wagon leaves the dump the doors swing back to a half-closed position.

This type of construction has enabled the makers to keep the body of the wagon low, and to secure a large capacity without using a long wheel-base. The bottom of the box is on a line with the center of the rear axle, and its top is at the height of the top of the rear wheel. The doors are fitted with automatic locks which draw them together at the center and hold them securely in place. When a perfectly tight bottom is required, the doors are fitted with a 3-in. steel center-lap. When this is used, a gear is provided to lift the door carrying the lap slightly in advance of the other, so that no interference of the edges is possible.

The device for closing the doors is very simple. One lever is used to revolve the chain shaft, and another to retain a ratchet and act as a lock when the doors are raised. When the load is to be dumped, one of these levers is lifted by the driver, releasing the ratchet and allowing the doors to open. About half a revolution of the chain shaft is sufficient to close the doors.

These wagons are made in several types. For railroad contractors, they have a 62-in. gauge, wood axle, outside lifting chains, fifth wheel gear, either stiff or drop tongue, and two or three horse hitch; the capacities are 1¼, 1½, 2 and 3 cu. yd. For city contractors, the gauge is 56 in. and steel axles are used. A special type has been designed with capacities of 3, 4 and 5 yd. for ashes and garbage, and another special type of 1, 1½, 2 or 3 yd. capacity for asphalt and paving materials.

THE WHEELER-MULLAN HIGH VACUUM SYSTEM FOR STEAM TURBINES.

The development of the steam turbine to its present high state of efficiency may have wonderfully improved the conditions existing along certain lines in the many power plants in which it has been installed; but its development has also called for greater improvements in auxiliaries to meet these conditions, the most important of which is the condenser, as it becomes absolutely necessary to secure the highest vacuum and efficiency obtainable for the successful operation of the turbine.

To meet these new conditions the C. H. Wheeler Condenser & Pump Co., of Philadelphia, is placing on the market a new high vacuum system, specially designed for steam turbine service. The arrangement of the equipment provides from 30 to 40 ft. of the lineal travel of the condensing water, which first enters the upper tubes of a surface condenser with final discharge from its lower section. Working in conjunction with this new apparatus is the Mullan suction valveless air pumps, crank and fly wheel design.

The Century Cement Machine Co., Rochester, N. Y., has recently constructed molds for bases, columns and capitals which greatly extend the field of concrete block construction. This new line of molds is in line with the company's policy of giving variety to the design of building blocks, so as to avoid monotonous effects.

THE ERIE— C. H. & D. CONSOLIDATION.

On Wednesday, President Underwood of the Erie R. R. announced the purchase by that company of a majority of the stock of the Cincinnati, Hamilton & Dayton Ry. This announcement was expected for some time, as the C., H. & D. is in a position to form an admirable extension of the Erie. It is a consolidation of the old Cincinnati, Hamilton & Dayton Ry., the Pere Marquette R. R., and the Chicago, Cincinnati & Louisville Ry., the total length of the lines being 3,675 miles. The Pere Marquette lines extend from a point near St. Thomas, Ont., nearly to Chicago, entering that city over the Michigan Central lines, which are also used to enter Buffalo. The Chicago, Cincinnati & Louisville will give the Erie a short route between Chicago and Cincinnati. The old Cincinnati, Hamilton & Dayton system, connecting Cincinnati with Indianapolis, Springfield, Toledo and Fort Wayne, is well situated for connecting Cincinnati with all points north, and, by the new Erie arrangement, with the whole northern tier of States. The purchase of these lines gives the Erie about 6,765 miles of track.

The Cincinnati, Hamilton & Dayton last year acquired $12,854,500 of the $16,000,000 common stock of the Pere Marquette, and later took over the property on a 999-year lease. Subsequently the two companies purchased the entire capital stock of the Chicago, Cincinnati & Louisville, giving in payment $3,500,000 of joint collateral trust bonds. The capital stock of the Cincinnati, Hamilton & Dayton consists of 80,000 shares ($8,000,000 par value), all of one class, practically all of the preferred stock having been purchased by the company in 1904. Its bonded indebtedness amounts to $28,103,000, not including the $50,000,000 4½ per cent bonds authorized last January, of which $25,000,000 are reserved to retire existing bonds, and it has outstanding $15,000,000 gold notes. The Erie has outstanding $112,378,900 common stock, $47,892,400 4 per cent first preferred and $16,000,000 4 per cent second preferred. Its total bonded indebtedness, including old bonds, bonds on properties controlled by ownership of entire or majority of capital stock or by lease, and new bonds of the present Erie Railroad Co. is more than $200,000,000. The Erie has under way and in contemplation extensive and costly betterments, including the construction of cut-offs to avoid heavy grades and the laying of additional tracks on a large part of the system.

A NEW PUSH CART FOR TRANSPORTING CONCRETE.

Concrete is ordinarily carried in wheelbarrows from the mixer to the place of deposit. A wheelbarrow holding 2 cu. ft. of concrete is a heavy load, and where the concrete is very wet, a load of but 1 cu. ft. is not uncommon. Since the ordinary barrow has a shallow bowl, it allows wet concrete to flow over its sides, thus preventing any heaping up of the load. A new concrete cart just put upon the market is made entirely of steel and designed to carry 6 cu. ft. as a load. The handle by which the cart is pushed may be fastened so that the bowl of the cart can be revolved a full half circle until it is upsidedown, or it may be so fastened to the other end of the bowl that the nose of the latter will strike either the run-plank or the wooden forms, so that the bowl cannot assume an upsidedown position. When concrete is being deposited for pavement foundations, or for floors of concrete steel buildings, or for reservoir work, the handles are fastened in the former position, but when the concrete is being deposited in wooden forms, as in retaining walls, dams or the walls of concrete steel buildings, it is preferable to have the handles fastened so that the nose of the cart will strike against the end of the runway or against the forms into which the concrete is being dumped.

While these carts can be used with great advantage in transporting concrete mixed with shovels, they are particularly useful where concrete mixers are employed, for with a comparatively level runway of plank, it is possible for one laborer to convey the equivalent of three large wheelbarrow loads, and with no greater effort than is required to push a wheelbarrow. No concrete is spilled over the sides of the bowl, owing to its special shape, so that the runway does not become covered with materials that increase labor of transportation. A very slight amount of dirt on a run-plank will greatly increase the force required to push a cart or wheelbarrow over it, and where the plank is covered with sloppings from wheelbarrows the resistance is correspondingly greater. In loading the cart from concrete mixers, very little time of the mixer is lost, in fact, it takes no longer to load the 6 cu. ft. of concrete into one of these carts than is required to load the 1 cu. ft. into the wheelbarrow, from which it is obvious that the daily output of the mixers can be greatly increased where carts are used.

Among those who are using large numbers of these carts may be mentioned: The Expanded Metal Fireproofing Co., of Pittsburg; Frank D. Gilbraith, of New York, and the National Fireproofing Co., of Pittsburg. These concrete carts are made by the Ransome Concrete Machinery Co., of 11 Broadway, New York City.

MORE NEW YORK AND NEW JERSEY TUNNELS.

On Wednesday information was furnished concerning the projected tunnels between New Jersey and New York with which the Public Service Corporation of New Jersey has been known to be identified for some time, although it is now stated for the first time that the Metropolitan Street Ry. of New York is also a party to the project. The work will be done by two companies. There has been incorporated at Trenton the Interstate Tunnel Railway Co. of New Jersey, with a capital stock of $7,500,000, the incorporators being Thomas N. McCarter, Charles A. Sterling, Albert B. Carlton, Mark T. Cox, H. H. Vreeland, John B. McDonald, John D. Crimmins, R. A. C. Smith and Henry D. Macdona. The Interstate Tunnel Railway Co. of New York has been incorporated at Albany with the same capital stock by the same men.

The route of the tunnel is a practically straight line from near the intersection of Erie and 12th Sts. in Jersey City to the terminus of the Brooklyn Bridge in Manhattan. The line passes under the Erie terminal at Jersey City, and an announcement has been made that there will be a connection between that terminal and the tunnel railway. In connection with the tunnel the Public Service Corporation will build a new high-speed line from Newark to Jersey City, so that passengers can be carried from Newark to the Brooklyn Bridge in about 20 minutes.

Although nothing definite is announced concerning the subject of a connection of this route with the new subways to be built in Manhattan, it is safe to assume that provision has been made for such a connection with the subways that the Metropolitan Street Ry. Co. will build if it gets an opportunity to do so. Leaving that connection aside, however, the route of the tunnel railway crosses the surface lines on several of the north and south streets, so that transfer connections will be possible at a number of places.

When work will begin depends on the action of the New York courts in settling the right of the Rapid Transit R. R. Commission and the Board of Estimate in New York to approve franchises without the consent of the Board of Aldermen.

THE SELECTION OF MOTORS FOR TRACTION PURPOSES.

By A. H. Armstrong, in "Street Railway Journal."

Electric railway engineering has been referred to as being a case of following the fad or fashion in vogue at the time, and many installations would seem to bear testimony to this accusation. Undoubtedly there are many cases of Jones purchasing a given motor because Manager Smith has been having good results with the same motor on his road, entirely ignoring the fact that the operating conditions upon the two systems may be totally dissimilar.

When the need was felt for a generating and distributing system of wider scope than the direct-current, 600-volt system, thus giving rise to the development of the rotary converter, it was thought the converter system was proposed and installed in many instances because the tide of railway engineering fashion was turning in that direction, rather than on account of its superiority over the direct-current system. While some managements have been slow to avail themselves of the advantages of alternating - current generation and transmission for this reason, it is a noteworthy fact that direct - current systems continue to be replaced by the alternating-current, but no instance has come to the writer's notice of the management of a road abandoning the alternating-current transmission system after trial and readopting the direct-current system as being superior.

The introduction of high potential alternating-current transmission to the rotary converter made possible the suburban and interurban electric roads of to-day, and greatly broadened the possibilities of electric railroading. In the development of the single-phase alternating-current motor, now in successful commercial operation, we have a new influence at work of a far-reaching character. As the field of the railway motor has expanded, so the requirements of the motive power have become so varied as to make it difficult for any one motor system to meet successfully all the conditions imposed. The direct-current series motor is a highly developed and efficient piece of apparatus, and, moreover, very adaptable to the diversified character of general railway conditions. The large sums spent in developing the different types of alternating-current motors are not due to any dissatisfaction with the direct-current motor as such, but because it has become necessary to reduce the cost of the secondary distribution system, which is still high with direct current, even with the advantage of the rotary converter. The advantages of high potential transmission are now evident to all, and it is proposed to carry this advantage still further, reduce the cost of the secondary distribution by raising the potential and dispense with the rotary converter.

The case is not quite analogous to the introduction of the rotary converter, as the adoption of the latter did not interfere in any way with the motive power question itself. The change from a direct-current to an alternating-current motor is more radical, and is advocated only on account of the lesser first cost of the trolley distributing system, and is not due in any way to any superiority of the alternating-current motor itself.

The alternating-current, single-phase motor with its attendant step-down transformer constitutes a heavier, more expensive and less efficient equipment than is offered by the direct-current motor with the series parallel controller. The alternating-current motor is also less flexible in its design, gives a pulsating torque and is restricted to a commutator potential of about 200 volts, but, nevertheless, its adoption for certain classes of railway service may be well justified. The car equipment constitutes but one link in the system of transmitting power from engine to car axle, and while the limitations of the alternating-current motor are regrettable, they do not in every instance introduce objections sufficiently serious to outweigh the considerable reduction in expense of the distribution system which the adoption of the high potential trolley effords. Limitations in design are reflected in the cost and bulk of the apparatus employed, but the copper and sub-station economy effected by the use of a 3,000-volt trolley may outweigh the extra expense of installing an alternating-current car equipment for certain classes of service.

Perhaps it is too early in the history of the alternating-current railway motor to attempt to define its precise field of usefulness, but some of its advantages as well as some of its limitations stand out so prominently as to make possible some general comparisons with its direct-current competitor.

Both the single-phase commutator and three-phase induction types of motor have been proposed for city service. This class of service demands frequent stops and high schedule speed, thus calling for successive overloads on the motors in order to obtain the high rates of acceleration required. The schedule speed of frequent stop service is always the result of a compromise between the rate of acceleration permissible without discomfort to the passengers and the frequency of stops required to pick up and drop the passengers.

The chief requirement of the motive power is that it shall be able to commutate heavy applications of current at very frequent intervals without experiencing a rise in temperature above the 65° to 70° C. permissible with reasonable life of the insulation. The method of control must permit of a high "efficiency of acceleration" —that is, all losses external to the motor, such as starting resistance losses, must be eliminated so far as possible. The requirements for frequent stop service are most exacting upon the motive power and its control, and the direct-current series motor and series parallel controller may be looked upon as the survival of the fittest, having proved superior to the horse, cable and steam locomotive for such work.

The three-phase induction motor has been proposed for rapid transit frequent stop service, but has fortunately never had an opportunity to demonstrate it unfitness for the work. Aside from the complication of double-trolley construction in cities, the induction motor system is inherently inefficient during acceleration, even though concatenation of motors be resorted to. Being a motor of synchronous characteristics, no motor curve running is possible, and the external resistance losses during acceleration or fractional speed running are necessarily large. The absence of the commutator does not compensate for the extra energy consumption required with induction motors operating on frequent stop service, due partly to the poorer efficiency of acceleration compared with that possible with direct-current motors, and partly due to the increased weight of the induction-motor equipment itself. The induction motor is inherently a constant speed, constant duty motor, and does not possess the qualifications of a successful motor for rapid transit service.

The single-phase commutator motor possesses all the advantages of variable speed characteristics enjoyed by the direct-current series motor, which, together with the possibilities opened up by potential control, led to many predictions being made that the direct-current motor was destined to be superseded for frequent stop service. An examination of the efficiency curves published of the single-phase motor indicate a curve rising rapidly at light loads, but drooping on overloads, the qualification of a motor adapted to infrequent stop service. In accelerating, the larger part of the motor duty is performed on the drooping portion of the alternating motor efficiency curve, thus giving rise to an internal motor loss considerably in excess of that experienced by a direct-current motor with its sustained high overload efficiency. In order that the single-phase motor may dissipate this excess energy loss without an injurious temperature rise, it is necessary to increase its weight and bulk in proportion. As an example, a comparison may show that the average efficiency during acceleration may approximate 85 per cent. with an alternating-current motor and 90 per cent. with the direct-current, thus calling for an alternating-current equipment weighing fully 50 per cent. in excess of the standard direct-current equipment, making the broad assumption that each type of motor can dissipate equal losses per square inch of radiating surface for the same temperature rise. While the alternating single-phase motor can be built to commutate successfully the heavy starting currents required in accelerating, the extra weight and cost of the equipment is a serious handicap in a class of service where the frequency of cars makes the cost of the rolling stock a matter for earnest consideration. The single-phase motor has thus far shown no indication of being superior or even equal to the direct-current motor, and when operated with an equal trolley potential seems to offer no advantages warranting its adoption. The direct-current motor is capable of being built for any potential considered safe for city or urban operation, and provides the lightest, cheapest and most efficient equipment yet developed for a class of service requiring frequent and rapid acceleration of the moving units. Continued development may bring the single-phase motor to a degree of perfection where it will compare favorably with the direct-current motor, but even so, the alternating-current motor system is permanently handicapped by higher track resistance and higher maximum trolley potential for the same average, still retains the commutator, while our experts leave us in doubt about its completely curing the electrolysis evil.

Where the use of a high potential trolley is permissible and stops are infrequent, conditions obtaining upon our private right of way suburban systems, the single-phase motor system offers claims for recognition which cannot be ignored. The success of our electric roads and the demand for better facilities has led to the introduction of heavy cars operating at such high schedule speeds that the cost of the trolley or third-rail distributing system has become a serious item, even with the advantage of the rotary converter fed from a high potential transmission line. Just as our city railway systems exceeded the economical limits of direct-current distribution, so are our large, long-distance electric roads demanding a higher potential than can be furnished by direct-current generation and used by the subdivided motive power on a car. A 1,200-volt, direct-current system offers relief in this direction, and in some instances may prove of considerable value in solving the problem of a cheaper secondary distribution system. There is also the possibility open of using three-wire systems with 600 volts or 1,200 volts on a side, so that we have not as yet reached the limits of direct-current distribution. Any considerable increase of potential over the 600-volt systems now in use necessitates abandonment of the third rail and the adoption of some overhead third-rail or trolley construction. Although it may be possible to design certain constructions of protected third rail which can be used for more than 600 volts, it is probable that high-voltage systems of the future will be compelled to use overhead construction.

The synchronous characteristics of the three-phase induction motor debarred this type of motor from the suburban field with its broken profile. The single-phase commutator motor, however, adapts its speed to the grade, and in this respect is equal to the direct-current series motor, while the use of potential control gives the opportunity of continued operation at any speed called for by the profile of the road without impairing the efficiency of operation. With infrequent stops, the heating due to accelerating losses is minimized, while the efficiency of the motors during free running is excellent.

While the single-phase motor appears limited by the low-voltage commutator and other considerations to a moderate output, it has been developed in capacities large enough to meet the requirement of single-car suburban service. Recognizing the necessity of terminal operation over city tracks equipped with direct-current trolley, the manufacturers have brought out alternating-current railway equipments capable of both alternating-current and direct-current operation, thus providing a system of great flexibility and one well adapted to avoid conflict with existing systems. Thus, while the single-phase motor equipment offers no assurance of better or cheaper operation, it does permit of a considerable reduction in the first cost of installing a suburban system operating single cars on private right of way, where the use of a high potential on the trolley is permissible.

The successful operation of high potential trolley roads has made it possible to consider the equipping of certain sections of our steam roads now using the steam locomotive under conditions unfavorable to its economic operation. The conditions imposed by the different problems presented again call for qualifications not possessed by any one single electric system. The steam road operator has found it necessary to divide his system into sections, design his locomotives for local conditions and proportion the tonnage of trains according to the profile. So the system of electric operation well adapted to take care of the needs of one section of the road may fail to respond to the requirements of another section, thus emphasizing the necessity of adapting the motive power to local conditions.

Electrical engineers are able to produce a successful system of operation for even the heaviest character of railroad service, but rather disagree upon which method of operation is most economical and can be installed for least expense. Undoubtedly, this apparent lack of agreement is brought about by the attempt to reconcile engineering recommendations made where the operating conditions are widely different. Thus, the induction motor is well adapted for haulage work where the profile is regular, either level or a continuous, unbroken grade, but the locomotive so equipped makes a poorer showing over a road having a broken profile than would other types of motors having good variable speed characteristics.

The economies of freight haulage tell us that the lowest cost of carrying a ton 1 mile is secured by the operation of the heaviest train which the design of the locomotive and strength of the drawheads will permit. This means a much more infrequent service than that obtaining in the majority of electric roads, and seems to exclude any system of operation that does not employ a high potential trolley. The local demand for power imposed by such heavy train units operating at infrequent intervals brings the first cost of any direct-current trolley or third-rail system too high for serious consideration.

Perhaps the most vulnerable point in the operating sheet of a steam locomotive system lies in the present high cost and dangers of operating heavy mountain grade sections. Not only does the steam locomotive give poor economy and small output when working at nearly full stroke at speeds of 6 to 10 m.p.h., but its cost of maintenance is excessive and crew expenses high, due to the small mileage obtainable. The energy stored in lifting trains up grade is all wasted in braking coming down. This loss of energy may be partially restored with an electrical haulage system effecting an economy in the coal consumption, but more especially relieving the brake-shoes and preventing accidents from broken wheels due to overheating.

Whether the system adopted for a given installation be the single-phase commutator motor, the three-phase induction motor or motor-generator sets on the locomotives feeding direct-current motors on the axles, will depend upon the requirements, as no one of these systems is flexible enough to meet all the conditions that may arise in an extended system. The advocates of the single-phase commutator motor must contend with the difficulties of a low-voltage commutator, pulsating torque, not very high efficiency and a preference for high rotative speeds, inherent in this type of motor. While these difficulties have been overcome and a commercially operative system evolved for the smaller capacities of motors suitable for suburban single-car, high-speed service, considerable difficulties in regard to commutation, ventilation and general mechanical design of the locomotive itself must be overcome before proposing such a radical departure from the successful designs possible with the greater latitude allowed in direct-current and induction motor design. For high-speed service on level track on the contrary, the single-phase motor may be developed for considerable output. The commutator motor, the three-phase induction motor and the various combinations of motor-generator sets may all receive power from a high potential trolley, and a judicious selection of the proper system to meet the general conditions involved seems better than a strict adherence to any one system of operation when it shows its inferiority in specific instances.

WALTER H. WHITESIDE.

Uniformity in type of equipment is very desirable, but may sometimes be purchased at too high a cost, and the best interests of a large electric railroad system are conserved by properly adapting the motive power to the requirements of the different sections.

PERSONAL NOTES.

Mr. Archibald Glasseo has been appointed bridge engineer of the Grand Trunk Pacific Ry., with offices at Montreal.

Mr. Eugene Holcomb has been made manager of the newly created foreign department of the Allis-Chalmers Co.

The offices of Eaton & Brownell, mill architects and engineers, have been moved to the Smith Bldg., Watertown, N. Y.

Mr. J. F. Witmer, of Buffalo, N. Y., has joined the staff of J. G. White & Co. to undertake special work in hydraulic engineering in foreign fields.

Mr. L. Duncan, recently engineer of the Taylor-Moore Construction Co., has joined the bridge and building department of the Denver & Rio Grande R. R.

Mr. W. L. Elkin has been transferred from the Pittsburg division of the Southwest system of the Pennsylvania Lines to the position of assistant engineer of the Michigan division of the Vandalia lines.

Frederick C. Rossiter, well known in Chicago engineering circles, was recently killed by a train at North Hammond. In addition to his engineering work he was actively interested in various State boards.

Mr. Wm. H. Bush, for 16 years assistant engineer of the Missouri Pacific Ry., has resigned to accept the position of assistant engineer of maintenance of way, Kansas City Southern Ry., with offices at Pittsburg, Kan.

Mr. G. C. Cleveland, formerly assistant chief engineer of the Lake Erie & Western R. R., has been appointed assistant chief engineer of the Lake Shore & Michigan Southern R. R., with offices at Cleveland.

Mr. Thos. J. Wyche has resigned his position as resident engineer of the Union Pacific Ry. at Omaha, to become supervising engineer in charge of construction of 282 miles of the Western Pacific Ry. from Salt Lake City westward.

Mr. Wm. E. Swift has been compelled on account of malaria to resign his position of resident engineer on the Panama Canal work. He has joined the engineering staff of the New York Board of Water Supply at New Hamburg, Conn.

Mr. R. B. Burns, chief engineer of the Santa Fe Coast Lines, has been granted a leave of absence on account of ill health, and his duties will be taken up in the mean time by Mr. C. A. Morse, assistant chief engineer of the Santa Fe System. Mr. Burns' leave runs until Jan., 1906.

Prof. A. H. Ford, of the department of electrical engineering, in the Georgia School of Technology, has resigned to accept a similar position at the University of Iowa. He will be succeeded at the Georgia School by Prof. R. W. Hargrave, now at the University of Michigan.

Harold A. Boedker, junior member of the Pittsburg contracting firm of F. A. Maselli & Co., died early this month. He was a graduate of a Norwegian technical school and of late has been well known for his careful study of contractors' plant, in which he made many improvements.

Messrs. W. W. Corbet and G. A. Collins have opened engineering offices in Santa Fe, N. M., for civil, irrigation and mining work. Mr. Corbet is a Columbia graduate with long experience in mining enterprises, and Mr. Collins is now chief engineer of the Santa Fe Irrigation & Development Co. and the Chaca Coal & Iron Co.

Dr. C. P. Matthews, for several years professor of electrical engineering at Purdue University, has been appointed director of the electrical laboratory and placed in charge of the school of electrical engineering. Mr. W. O. Teague has been appointed assistant professor of experimental engineering, in charge of the engineering laboratory, and Mr. Albert Smith has been appointed assistant professor of civil engineering.

The shifting of engineers on the Pennsylvania Lines has lately resulted in the transfer of Mr. Guy Scott to the position of assistant engineer of the Chicago Terminal division of the Northwest system, and Mr. W. A. Haw-engineer at Wellsville of the Cleveland and Pittsburg divisions of the Northwest system, and Mr. W. A. Hawley to the position of assistant engineer at Richmond of the Richmond division of the Southwest system.

Mr. W. G. Carlton, formerly of the Chicago Edison Co. has just been appointed superintendent of power of the electrical zone of the New York Central & Hudson River Railroad Co. In this capacity Mr. Carlton will have charge of the two main electric power stations which the company is building near New York, the eight substations and the transmission system. He will report to the electrical department. Mr. Carlton has been associated with the Chicago Edison Co. for the last twelve years, and is at present assistant to the chief operating engineer. He was born in Warren, Ill., in 1869, and is a graduate of Cornell University, class of 1892. After leaving college he spent a year in taking the students' course with the General Electric Co., at Lynn, after which he entered the construction department of the Chicago Edison Co.

The election of Mr. Walter H. Whiteside as president of the Allis-Chalmers Co., announced last week, is an indication that the change in the presidency will not mean a change in the policy of the company, for Mr. Whiteside has been, during the absence in Europe since April last of his predecessor in office, in full charge of the operations of the organization with the title of vice-president and general manager. Mr. Whiteside joined the Allis-Chalmers interests in July, 1904, when he accepted the position of general manager of sales. He came at a time when the company, which had just taken over the Bullock Electric Manufacturing Co., needed the injection of a vigorous and energetic personality into its sales force. He had to become familiar with all the intricacies of the company's varied products—and they cover a larger field than that of any other great manufacturing corporation—but the new interests and the old had to be consolidated. The sales organization had to be enlarged and its efficiency increased. With what success Mr. Whiteside has met in his efforts, the increase in the volume of the company's business, the crowded shops and the reopening of the old South Foundry at Milwaukee can testify. In taking up this higher and more responsible position, Mr. Whiteside has behind him not only the confidence of his organization, but a long and varied business experience, in which he has filled many executive positions. His achievements have won him recognition as a man of marked administrative ability.

CONTRACTING NEWS
OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Ft. Morgan, Colo.—A contract is reported to have been signed between the Bijou Irrigation Co., composed of Confield & McCreery, of Greeley, and F. H. Shields and Josh Work, of Ft. Morgan, transferring their rights in the Bijou ditch, Bijou reservoir and Empire reservoir to the Bijou Irrigation District. It is expected that work will be rushed on the Empire reservoir just as soon as an election can be called to vote district bonds, and the promoters expect to store some water this winter. The reservoir is 16 miles in circumference and will be filled to capacity.

Greeley, Colo.—Press reports state that about $250,000 will be expended to increase the water supply. Louis Stimson, City Surveyor, is reported to have made a survey for the pipe line. Three reservoirs will be built.

Apalachicola, Fla.—The citizens are reported to have voted Sept. 12 to issue $50,000 bonds for the construction of water works and a sewerage system.

Colquitt, Ga.—N. S. Stapleton, Mayor, writes that an election will be held Oct. 10 to vote on issuing $6,000 bonds for the construction of water works.

Dawson, Ga.—The citizens are reported to have voted Sept. 12 to issue $45,000 bonds to purchase and enlarge the plant of the Dawson Water Wks. Co.

Rock Island, Ill.—It is stated that bids will be received until Oct. 2 by H. C. Schaffer, City Clk., for a pumping engine for water department.

Oswego, Ill.—Bids will be received until Oct. 2 by the Village Clk. for furnishing and laying 1,120 ft. 4-in. c. i. water pipe and 160 ft. 1-in. galvanized iron pipe and appurtenances, as advertised in The Engineering Record.

Chicago, Ill.—Local press reports state that it is proposed to construct a water tunnel 13 ft. in diam., from the 68th St. crib to 73d St., and west on 73d St. to State St. Here a 9-ft. tunnel will begin going south to 103d St. The plant also includes a new crib at 55th St., with another tunnel and an independent water system for the stockyards district, which will cost in all about $1,500,000. Bids will probably be received about Jan. 1. John Ericson, City Engr.

Benton, Ill.—Water works and sewers are contemplated for Benton, to cost $35,000. Hiram Phillips, Consulting Engr., St. Louis, Mo.

**Huntley, Ill.*—The Marengo Foundry & Machine Co., of Marengo, is reported to have secured the contract for constructing water works for $6,000.

Quincy, Ill.—The Citizens' Water Wks. Co., of Quincy, is contemplating improvements to its plant and have retained Hiram Phillips, of St. Louis, Mo., as Consulting Engr.

Kankakee, Ill.—The City Council has under consideration the purchase of the plant of the Kankakee Water Co.

**Bradley, Ill.*—Eben B. Gower, Town Attorney, writes that contracts (bids opened Aug. 26) have been awarded as follows: Furnishing water pipe to the U. S. Cast Iron Pipe & Fdy. Co., Chicago, Ill.; hydrants to the Rensselaer Mfg. Co., of Troy, N. Y., and for laying pipe to T. H. Iglehart; total cost reported to be $16,000.

St. Charles, Ill.—Mayor Glenn is stated to have appointed a committee, consisting of City Attorney Chas. A. Miller and Aldermen Henry Rohlk and Fred. E. Gifford, to take up the preliminary work of constructing a water system.

Marlow, Ind. Ter.—J. R. Rogers, Town Recorder, writes that it was voted Sept. 12 to issue $20,000 bonds for constructing water works.

Perry, Ia.—The Council is reported to have in contemplation the laying of 3,000 ft. of water mains.

Casey, Ill.—The Council is reported to have decided to construct water works.

Lebanon, Kan.—The citizens are reported to have voted to issue bonds for the construction of water works.

Williamsburg, Ky.—The question of constructing water works is reported under consideration here.

Abbeville, La.—The Town Council on Sept. 9 selected Wm. Mackintosh, of Houston, Tex., as Consulting Engr. for the proposed water works, for which about $50,000 is available.

Baltimore, Md.—It is reported that a survey is being completed by the Water Dept. looking to the establishment of a storage reservoir at Loch Raven. Instead of the present reservoir the plan includes the building of a large lake, which will constain 17,000,000,000 gal. of water and will supply a smaller reservoir located nearby, the Lake Clifton and Lake Montebello reservoirs and the Lake Roland reservoir.

Waltham, Mass.—The Com. on Finance has voted to adopt the ordinance appropriating $37,000 for a covered reservoir west of the present basin; $21,000 to sink a well and provide equipment for additional water supply and $21,000 to extend the sewerage system to the Roberts District.

Detroit, Mich.—Water Comr. John F. Dodge is stated to have reported to the Water Comn. that the 4 horizontal tubular boilers should be replaced by vertical or high pressure water tube boilers. The Comn. is reported to have decided to employ Field, Hinchman & Smith to make further examination and prepare plans and specifications for improvements needed at the water works.

Hancock, Mich.—A. F. Macdonald, City Clk., writes in regard to the construction of a reservoir on Quincy Hill, that nothing definite will be done this year, but it is expected that early next season work will be begun.

Waverly, Minn.—C. E. Wright, Village Recorder, writes that the citizens voted Sept. 14 to issue $8,000 bonds for water works. Bids will be received about Nov. 1.

East Grand Forks, Minn.—F. W. Cappelen, Consulting Engr., Minneapolis, writes that bids will be received until Oct. 6 for the construction of water works at East Grand Forks. E. R. Jacobs, City Recorder.

Willmar, Minn.—See "Power Plants, Gas and Electricity."

Shelby, Miss.—Bids will be received until Sept. 27 by the Bd. Mayor and Aldermen (T. J. Mayers, Clk.) for $25,000 water and sewerage bonds.

Kansas City, Mo.—Bids will be received until Oct. 14 by the Bd. Pub. Wks. (Everett Elliott, Secy.) for furnishing material and constructing 2 shafts of 8-ft. inside diameter, and connecting the same under the Kaw River, with a tunnel of 7-ft. inside diameter and about 1,125 ft. in length.

St. Louis, Mo.—Two ordinances have been submitted to the Bd. of Pub. Improvements; one provides for laying several miles of pipe in old and new parts of city at a cost of $100,000; the other provides for the purchase of special castings, valves and fireplugs, at a cost of $285,000.

Falls City, Neb.—At a recent election the proposition to bond the city for water works extension was defeated. Another election has been called. Hiram Phillips, of St. Louis, Mo., Consulting Engr.

Goffstown, N. H.—It is reported that contract will shortly be let for the construction of a concrete-steel dam and for the excavation of a basin for a storage reservoir. John G. Dodge, Chmn. Water Com.

Orange, N. J.—The Common Council is reported to have on Sept. 18 adopted plans for the new distributing water system and bids will be received until Oct. 9; the total cost will be between $170,000 and $200,000. The work will be divided in four parts: Section 1 to include the 20-in. main from Campbell's Pond to the new reservoir; Sect. 2 the construction of the main from the new reservoir to the city; Sect. 3, the construction of the reservoir, and Sect. 4, the building of the dam at the reservoir.

New York, N. Y.—Justice Bischoff rendered a decision in the Supreme Court on Sept. 15, making permanent the injunction restraining the Aqueduct Comrs. from prosecuting the work of constructing the Cross River reservoir, on the Croton Watershed. The bids for this work were opened on May 31 and the contract awarded to McArthur Bros. Co. & Winston & Co., of N. Y. City, and Clinton, Mass., for $1,246,212. It is stated under this decision the Aqueduct Comrs. will have to draw up new plans and specifications for the Cross River Reservoir and procure new bids.

**Brooklyn, N. Y.*—Chief Engr. De Varona is reported to have recommended awarding to the D'Olier Eng. Co., 74 Cortlandt St., the contract for furnishing 8 electrically driven pumps for high pressure fire service, bids opened July 19 by John T. Oakley, Comr. Water Supply, Gas and Electricity, N. Y. City. This company bid for 5 pumps, $110,701, and for the 3 other pumps, $64,322. For list of detail bids received for this work see issue of The Engineering Record, July 29.

Buffalo, N. Y.—The following are the bids opened Sept. 12 by Francis G. Ward, Comr. of Pub. Wks., for installing at the pumping station, two 30,000,000-gal. vertical triple-expansion pumping engines: Lake Erie Engr. Wks., Buffalo, $215,000; Holly Mfg. Co., Buffalo, $224,750; Allis-Chalmers Co., Chicago, Ill., $243,950, and Wm. Todd Co., Youngstown, O., $262,000.

Mt. Hope, N. Y.—The Mt. Hope Water Supply Co. is reported incorporated, with a capital of $10,000, by Theo. Writer, C. W. Loomis and T. H. Easton, of Otisville.

Oneida, N. Y.—Water bonds to the amount of $45,000 have been sold, to be used for improving and enlarging the water works.

Matteawan, N. Y.—Bids will be received by the Village Trus. until Sept. 26 for reconstruction of and the building of certain additions to Mt. Beacon storage reservoir, as advertised in The Engineering Record.

Waverly, N. Y.—The citizens are reported to have voted to issue $125,000 bonds, to purchase the plant of the Waverly Water Works Co.

**Frederickston, O.*—Contracts for constructing the water works here are reported to have been awarded as follows: To Brooks & Son, Jackson, Mich., wells, pipe, hydrants, tanks and tower, $15,000; Reeves Bros., Columbus, gas engine, $1,230, and J. H. McGowan, of Cincinnati, pump, $1,153.

Lancaster, O.—It is stated that bids will be received until Sept. 26 by the Bd. Pub. Service (Geo. Cunningham, Clk.) for furnishing material and extending the water works, requiring 3,170 ft. 4-in. c.-i. water pipe, special castings, valves, etc.

**Toledo, O.*—Local press reports state that the Bd. of Pub. Service on Sept. 19 awarded to Wm. & John McMahon, of Toledo, the contract for building sections 1 and 2 of the filtered water conduit (bids opened Sept. 11), for $66,370.

Cincinnati, O.—Bids will be received by the Bd. Trus. Comrs. Water Wks. (Aug. Herrmann, Pres.) until Oct. 13 for furnishing and delivering filter, sand and gravel for the filtration plant.

Bids will be received until Oct. 13 by the Bd. Trus. Com. Water Wks. (Aug. Herrmann, Pres.) for laying c.-i. pipe and special castings and valves in Lundlow and Dodsworth Aves., for the extension and betterment of the water distribution system; the aggregate length of the main to be laid is about 2,970 lin. ft. 20-in. c.-i. pipe; also same date, for laying c.-i. pipe and special castings and valves under and across Mill Creek and along several other streets, including Queen City Ave. and Liberty St.

McMinnville, Ore.—It is reported that estimates are being prepared for a gravity system of water works. An election will probably be held to vote on question.

Pawhuska, Okla. Ter.—See "Power Plants, Gas and Electricity."

Williamsburg, Pa.—Bids will be received until Oct. 11 by W. P. Trostle, Secy. of Council, for furnishing and laying about 13,000 ft. 8-in. c. i. pipe and 2,700 ft. 6-in. c. i. pipe, building dam across Schmucker Run, etc. Henry & Dillman, Engrs., Altoona.

Philadelphia, Pa.—Local press reports state that plans are being prepared for the low-service pumping station, to be constructed at Torresdale. The Filtration Bureau is also reported to be considering the advisability of asking for bids for pumping out the Torresdale conduit.

Topton, Pa.—The Town Council is reported to have decided to construct a new reservoir.

McKeesport, Pa.—At a meeting of Council Sept. 11 an ordinance is reported to have been passed, providing for an election to vote on issuing $200,000 bonds for the construction of a filtration plant.

Manila, P. I.—Bids will be received until Oct. 2 by the Municipal Bd. (G. S. Lane, Acting Secy.) for furnishing material and constructing a gravity water supply. J. F. Case, Ch. Engr. Dept. of Sewer and Water Wks. Construction.

Aiken, S. C.—The City Council is reported to have decided to construct a new reservoir, with a capacity of 1,000,000 gals.

Columbia, S. C.—Bids will be received until Oct. 2 at the office of the City Clk. and Treas., for $400,000 water works improvement bonds; for further information, address Mayor T. H. Gibbes.

**Franklin, Tenn.*—Contracts for constructing water works (bids opened Sept. 12) have been awarded as follows: Steel tower and tank, Chicago Bridge & Iron Wks., Chicago, Ill., $5,000; hydrants and valves, Rensselaer Mfg. Co., Troy, N. Y., $1,767, and for the pipe laying, reservoir, tower foundations and headworks at the springs, Howard Neely, of Chattanooga. Engineers, Kirkpatrick & Johnson, Jackson, Miss.

Ft. Worth, Tex.—Bids will be received until Oct. 5 by John F. Lehane, Chmn. Water Com., for furnishing material and constructing a compressed air plant for pumping purposes at Ft. Worth City Water Works. Capacity 3,000 cu. ft. of fresh air per minute, maximum pressure 200 lbs., working pressure 1,500 lbs. Bids will be entertained on steam, producer gas, or other motive power, bidders to guarantee performance and cost of annual repairs. John B. Hawley, City Engr.

Provo, Utah.—See "Power Plants, Gas and Electricity."

Richmond, Va.—E. E. Davis, Asst. Supt. Water Wks., writes that all bids opened Sept. 5 for constructing a reinforced concrete conduit, furnishing c.-i. pipe, etc., have been rejected. The work includes 2,417 cu. yds. 5-ft. and 50 cu. yds. 4-ft. concrete conduit; 330 lin. ft. 2½ ft. c. i. pipe; two 8-in., one 24-in. and one 30-in. valves; 2005 tons 42, 36 and 30-in. c. i. pipe; 30,000 lbs. specials; 2,643 cu. yds. rip. rap, etc.

Tacoma, Wash.—The Special Com. on Water is reported to have recommended that Council appropriate $10,000 for a preliminary survey to determine the cost of a water system from Green River and the Greenwater River.

The Mt. Tacoma Water Supply Co. is reported to have on Sept. 13 offered to furnish the city a total daily supply of 30,000,000 and add 30,000,000 gals. to the reservoir capacity for $1,750,000, the city to pay for the work of construction monthly, holding back a percentage, and the city also to pay for any solid rock at the rate of $1 per yd.

Ballard, Wash.—The Special Water Com. is reported to be in favor of the city installing its own water works.

Chinook, Wash.—See "Power Plants, Gas and Electricity."

Ft. Walla Walla, Wash.—Bids will be received until Sept. 30 by Noble H. Creager, Q. M., U. S. A., for installing water main, etc., at this post.

Waupaca, Wis.—Bids will be received until Oct. 2 by J. Woodnorth, City Clk., for furnishing material and improving the water works, including the following: 3,000 ft. 4-in. and 1,300 ft. 10-in. c. i. pipe and 2,000 lbs. specials, hydrants and valves, laying 5,528 ft. 4, 6 and 10-in. pipe, 1 75-k.w. d. c. generator, 75-h.p. motor and starting box switchboard; 10,200 ft. No. 0000 wire; water wheel governor for two 75-h.p. wheels; a 700-gal. high-lift centrifugal pump; power house; source of supply from tubular wells. W. G. Krichoffer, Engr., Madison.

**La Crosse, Wis.*—Wm. Forrestal, of Milwaukee, is reported to have secured the contract for laying 27 blocks of water mains (bids opened Sept. 9) for $12,000.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Little Rock, Ark.—It is proposed to petition City Council for the formation of a sewer district in the southern part of the city. The district will include 25th St. on the north to 29th St. on the south, and from Arch St. on the east to Izard St. on the west.

Marianna, Ark.—It is proposed to expend $30,000 in the construction of sewers. Max Muler, Chmn. Hiram Phillips, Engr., St. Louis, Mo.

**San Francisco, Cal.*—Frank G. O'Kane is reported to have secured the contract on Sept. 12 for constructing the 6th St. sewer for $55,734.

Pueblo, Colo.—It is proposed to expend about $250,000 in asphalt paving and extending the storm sewers. John T. West, Mayor. Hiram Phillips, Consulting Engr., St. Louis, Mo.

Denver, Colo.—Plans are being prepared by the Bd. of Pub. Wks. for the North Side storm sewer district, which is reported to be the largest of the city. Contracts will probably be let in a few weeks.

Danbury, Conn.—It is stated that bids will be received until Sept. 26 for constructing sewers and appurtenances in Crosby, Main and Franklin Sts., consisting of 718 ft. 12-in. c.-i. pipe, 3,652 lin. ft. 12-in. vitrified sewer pipe, 950 lin. ft. 10-in. vitrified sewer pipe, and 25 manholes complete. A. L. Davis, City Engr.

Washington, D. C.—Bids will be received until Sept. 28 (readvertisement) by Capt. A. W. Butt, Q. M., U. S. A., for constructing sewer from coal testing plant on U. S. Reservation at south end of Aqueduct Bridge, Rosslyn, Va., to the Potomac River.

Apalachicola, Fla.—See "Water."

Benton, Ill.—See "Water."

Chicago, Ill.—Bids will be received until Sept. 30 by the Dept. Pub. Wks. (J. M. Patterson, Comr.) for furnishing materials and reversing a portion of the 70th St. sewer.

**Chicago, Ill.*—Wm. F. Healy, 88 Washington St., has secured the contract for constructing about 2,250 lin. ft.

**Items marked thus give the names of parties awarded contracts.*

9 ft. brick and concrete sewer in a portion of Paulina St., for about $50,000.

The following are the bids opened Sept. 13 by the Dept. of Pub. Wks. for constructing intake protection piers and lake shaft for Lawrence Ave. conduit: Great Lake Dredge & Dock Co., $94,890; Jackson & Corbett Co., $153,999, and John P. Agnew, $184,200.

Chicago, Ill.—Bids will be received until Sept. 27 by the Dept. Pub. Wks. (J. M. Patterson, Comr.) for furnishing material and constructing the sewage screens and operating galleries for the 39th St. pumping station.

Newton, Ill.—The question of constructing a sewerage system is reported under consideration here. Mr. Kasserman, Mayor.

Des Moines, Ia.—Bids will be received by the Bd. Pub. Wks. (W. W. Wise, Chmn.) until Oct. 7 for constructing a 24-in. vitr. clay pipe sewer in a portion of Hayes St.

Creston, Ia.—Bids will be received until Oct. 2 at the office of A. W. Schimpff, City Clk., for constructing 730 ft. 6-in. salt glazed vitr. sewer pipe.

South Bend, Ind.—Alonzo J. Hammond, City Engr., is preparing plans for an intercepting trunk sewer for the business district.

Ardmore, Ind. Ter.—G. H. Bruce, City Clk., writes that the city contemplates voting in early spring on the construction of a sewerage system.

Lawrence, Kan.—Bids will be received until Oct. 2 (readvertisement) at the office of F. D. Brooks, City Clk., for furnishing material and constructing a main sewer in Tennessee and Penn Sts., requiring about 3,000 ft. 12-in. pipe and 7 manholes; also for lateral sewer in portions of other streets, requiring 2,380 ft. 8-in. pipe with Y junctions and 2 flush tanks.

Georgetown, Ky.—Bids will be received by the City Council, until Oct. 2, for $25,000 bonds for constructing a sewerage system; for further information apply to Mayor J. W. Keller.

Lexington, Ky.—The following are the totals of bids opened by Mayor Coombs on Sept. 13 for the construction of new main sewers: Hill-Gaynard Constr. Co., East St. Louis, Ill., $78,049; Guild & Co., Chattanooga, Tenn., $82,819; Alsop Eng. & Constr. Co., of Los Angeles, Cal., $85,247; Jas. H. McQuade & Co., Pittsburg, Pa., $88,320; Keeling & Ride Constr. Co., of Pittsburg, Pa., and Cincinnati, O., $90,682; A. L. Patterson & Co., of Macon, Ga., $106,034; Mason & Hoag Constr. Co., Frankfort, Ky., $109,510, and Paul & Kirshner, Dayton, O., $111,700.

Baltimore, Md.—City Engr. Fendall is reported to be preparing plans for the extension of the storm-water sewerage system and completing the work started early this year out of an appropriation of more than $100,000. He will report his plans to the Bd. of Estimate and it will then be decided whether the storm-water sewers are to be constructed under the supervision of Mr. Fendall or the Sewerage Commission.

Waltham, Mass.—See "Water."

Adrian, Mich.—John Mawdsley, City Clk., writes in regard to the construction of a sewerage system that no election will be held to bond until next spring.

Rochester, Minn.—The following are reported to be the bids opened Sept. 11 for constructing the east side sewer: W. D. Lovell, $18,960; M. Ford, $17,990; O'Neil & Son, $17,315, and W. C. Fraser, $16,975 (awarded contract).

St. Paul, Minn.—City Engr. L. W. Rundlett has presented to the Bd. of Pub. Wks. a preliminary report on local improvements; he estimates the cost of Thomas St. sewer system at $28,587 and for a sewer in Railway Pl. and Cromwell, Wabash and Hampden Aves., $28,165.

Bids will be received until Sept. 28 by the Bd. Pub. Wks. (R. L. Gorman, Clk.), for constructing sewers in portions of Cypress, Pacific and Jenks Sts.

East Grand Forks, Minn.—Bids will be received until Sept. 26 at the office of E. R. Jacobi, City Recorder, for constructing 1,900 lin. ft. 10-in. sewer; 330 lin. ft. 8-in. sewer connection; 5 manholes and 2 catchbasins, in portions of 6th St. and Allen Ave.

Shelby, Miss.—See "Water."

St. Joseph, Mo.—Local press reports state that the following are the bids opened on Sept. 1 for the construction of sewers (*a*) brick, (*b*) concrete, (*c*) concrete block, (*d*) reinforced concrete:

South St. Joseph sewer: Rackliffe & Gibson, *a* $72,379, *b* $65,221, *c* $65,156, *d* $62,294. Boyd Constr. Co., *a* $88,113, *b* $83,742, *c* $84,418.50, *d* $81,791. Wm. Mignery, *b* $91,966, *c* $91,965.70. John Mahoney, *a* $93,433, *b* $93,961. Wm. Land, *b* $111,700, *c* $107,310, *d* $99,960.

Wyatt Park Sewer: Rackliffe & Gibson, *a* $12,254, *b* $11,782, *c* $10,578. Boyd Constr. Co., *a* $14,622, *b* $12,546.60, *c* $12,554, *d* $12,354. John Mahoney, *a* $12,938.60, *b* $11,230. G. O. Skilbred, *a* $10,911, *c* $9,630. J. H. Hartman, *a* $10,995, *b* $11,306.

Dillon, Mont.—The question of constructing a sewerage system is reported under consideration here.

Helena, Mont.—At a joint meeting of the Street and Alleys and the Sewer Com. of Council, Sept. 13, it is reported, to have been decided to build a large oval sewer, probably of cement, to replace the old flume running west of Main St.

Nevada, Mo.—The lowest bid opened on Sept. 12 for constructing sewers was submitted by W. W. Cook & Sons of Junction City, Kan., as follows: 8,000 cu. yds. dirt. excav. and back fill, 42 cts.; 350 cu. yds. rock excav., $2; 10,864½ lin. ft. 15-in. pipe sewer, 48½ cts.; 3,870 lin. ft. 12-in., 33½ cts.; 8 manholes, ea., $30. The other bids received were: McClintock & Sargent, Houston, Tex., $11,698; T. W. Roberts, Independence, $12,256; W. F. Hall, Clinton, $13,526, and A. G. Robson, Pittsburg, Kan., $14,346. Jas. M. Clack, City Engr.

Dover, N. H.—Bids will be received until Sept. 28 by the Street & Park Comn. for constructing a sewer, as advertised in The Engineering Record.

Jersey City, N. J.—Bids will be received until Sept. 25 by the Bd. Street and Water Comrs. (Geo. F. Bouton, Clk.) for constructing a relief sewer in a portion of Merseles St. Approximate estimate of quantities: 280 lin. ft. 36-in. circular brick sewer; 84 lin. ft. 12-in. c.-i. pipe sewer; 3 cu. yds. concrete; 10 cu. yds. brick masonry; 6,000 lin. ft. piles driven; 6,000 ft. B. M. capping; 6,000 ft. B. M. flooring, and 10,000 ft. B. M. sheating.

Orange, N. J.—The Sewer Com. is reported to have been authorized by Council to take the necessary steps to have sewers placed in Beech, White, Chestnut and Thomas Sts.

Monmouth Beach, N. J.—John W. Slocum, of Long Branch, Township Counsel, writes that the question of constructing a sewerage system is under discussion, but nothing definite has been decided upon.

Merchantville, N. J.—It is proposed to construct a complete system of sewerage, in all about 8 miles, to include a septic tank and disposal plant complete. For further information address A. W. MacCallum, Chmn. Com. Merchantville.

New York, N. Y.—Bids will be received until Sept. 27 by John F. Ahearn, Boro. Pres., for reconstructing receiving basins in portions of Delancey St. Engineer's estimate: 11 receiving basins of the circular pattern, with new style grate bars and bluestone heads; 210 lin. ft. 12-in. salt-glazed vitr. stoneware pipe culvert; 2,500 ft. B. M. timber and planking for bracing and sheet piling; 1,000 ft. B. M. timber and planking for foundation; 6 cu. yds. brick masonry, laid in cement mortar, and 2 manholes of standard patterns.

Buffalo, N. Y.—The following are reported to be the bids opened Sept. 1 for constructing 30, 24, 15 and 12-in. tile and 24 and 18-in. c.-i. pipe sewer in Roseville, Hydraulic and Seneca Sts.: J. W. Dyer & Son, $30,857; Johnson & Mumm, $33,900; Miller & Franklin, $36,350; Wm. Franklin, $37,359; Dark & Co., $37,600, and W. G. Smith, $37,998.

Irondequoit, N. Y.—Albert E. Seitz, Town Clk., writes that the summer residents of Summerville are interested in the construction of a sewer and will pay all expenses, engage engineer to prepare plans, etc., which must be approved by State Bd. of Health.

St. Johnsville, N. Y.—It is stated that according to estimates prepared by engineers, the cost of constructing a sewerage system for St. Johnsville will be about $44,000.

New York, N. Y.—See "Paving and Roadmaking."

**Rochester, N. Y.*—Thos. Holahan, 164 Lewis St., is stated to have secured the contract for constructing the Park Ave. sewer, for $8,662.

Spencer, N. C.—A. W. Hicks, Town Clk., writes under date of Sept. 16 that bids will be received at any time for the proposed sewerage system and street improvements. Engineer, Francis R. Weller, of Graham.

Cincinnati, O.—Bids will be received by the Bd. Pub. Service (Geo. F. Holmes, Clk.) unil Sept. 28, for furnishing materials and constructing sewers and drains in Div. 20; also Oct. 10 in Div. 16.

Elyria, O.—It is stated that bids will be received until Oct. 15 by the Bd. Pub. Service (Scott Hyman, Chmn.), for constructing a 36-in. brick and a 24-in. vitrified pipe sewer.

Napoleon, O.—It is stated that bids will be received until Oct. 2 by F. W. Hilgendork, Village Clk., for constructing a combination storm water and sanitary sewer in Perry St.

Columbus, O.—Bids will be received until Oct. 4 by the Bd. Pub. Service (Chas. H. Frank, secy.), for constructing a sewer in the first alley west of Hawkes Ave., and in the first alley west of Parsons Ave.

Reading, Pa.—Mayor Gerber is reported to have signed the ordinance providing for permanent improvements to the sewage disposal plant at Millmont, and making an appropriation of $49,000 to the Bd. of Pub. Wks. to pay for same.

Local press reports state that the following are the bids opened Sept. 14 by the Bd. of Pub. Wks. for constructing sewers: (*a*) 3½ District, (*b*) 4th Dist., (*c*) 5th Dist., (*d*) 6th Dist., (*e*) 11th Dist.: Hawman Bros., Reading, *a* $178,954, *b* $114,904.24, *c* $146,730, *d* $119,920, *e* $131,636. David Peoples, Philadelphia, *a* $148,998.84, *b* 93,067, *c* $116,388, *d* $100,257, *e* $114,435. Jos. P. O'Reilly, Reading, *b* $116,735, *e* $131,135. Hawman Constr. Co., Reading, *d* $159,880.20, *e* $135,478. Fehr & O'Rourke, Reading, *b* $104,069, *d* $115,174.42. Wm. A. Ryan, Philadelphia, *b* $150,547.02, *c* $153,590.76; J. B. Waidelech, Allentown, *a* $195,948, *b* $164,165, *c* $161,652, *d* $120,789, *e* $137,156. Harris Constr. Co., Newark, *a* $111,713, *e* $135,941. T. H. Bowman, Philadelphia, *a* $220,570, *b* $130,843, *c* $166,898, *e* $158,530.37. Climax Constr. Co., New York, *a* $189,483, *c* $152,172, *e* $128,754.

*The Bd. of Pub. Wks. on Sept. 19 awarded the contract for the above sewer work to David Peoples of Philadelphia, for a total of $583,146. The Board also awarded to Jos. P. O'Reilly, of Reading, the contract for building a 54-in. circular sewer from Pine and Mifflin Sts. to 2d and Penn Sts. It will probably be of concrete and cost about $24,000.

Ballston Spa, N. Y.—Bids were opened Sept. 7 by the Bd. of Village Trus. for the construction of the sewage plant, etc. (John M. Farley, Engr., White Plains). Golden & Lansing bid only for the force main, $2.38½ per lin. ft., and for the sewer pipe, $1.92 per lin ft.; Chas. D. Beckwith bid only for the septic tank, beds, etc., lump sum $54,536, and the Ballston Stone Co. bid only for the crushed stone, $1.65 per cu. yd. The other bids received were as follows: (*a*) John E. Gaffney; (*b*) Flood, Sherrill & Lenihan; (*c*) Albany Material & Constr. Co.; (*d*) Cameron & Hawn Realty Co.; (*e*) Bacterial Sewage Purification Co.; (*f*) Bunting Constr. Co.; (*g*) Brown & Lowe:

	a	*b*	*c*	*d*	*e*	*f*	*g*
Septic tank, beds, etc. (lump sum)	$51,160	$57,745	$54,000	$60,000	$42,680	$40,714	$39,456
Rec. tank, station, pumps, etc. (lump sum)	13,187	17,200	15,900	20,000	12,875	16,000	15,254
Pump house (lump sum)	2,000	2,100	1,750	1,200	2,400	3,000	3,072
Gate houses, ea.	450	500	650	600	650	500	559
2,700 lin. ft. 12-in. force main	2.00	1.45	1.70	2.75	...	1.75	1.68
1,100 lin. ft. 20-in. sewer pipe	2.75	2.00	2.00	3.00	...	3.50	1.41
21,200 cu. yds. crushed stone	2.00	1.65	1.65	‡30,000	1.60	...	1.70
Total	$117,672	$118,810	$114,390	$123,125	$92,855	$69,289	$100,687

‡Lump sum.

Carrick, Pa.—The question of issuing $125,000 bonds for the construction of a sewerage system is reported to be under consideration at Carrick.

Versailles, Pa.—Bids will be received by R. H. McClure, Pres. Council, 318 Walnut St., until Oct. 5 for surveying a sewer system.

North York, Pa.—Ide & Heiges, of York, are stated to have completed plans for a sewerage system, and estimate the cost at about $3,900.

New Castle, Pa.—City Engr. Mulholland is reported to be preparing estimates for the construction of 8 sanitary sewers in different parts of the city.

Scranton, Pa.—Mayor Connell is stated to have signed the bill providing for the 9th Dist. relief sewer.

Manila, P. I.—Bids will be received until Jan. 12 by the Municipal Bd. (G. S. Lane, Acting Secy.) for constructing a system of sewers and appurtenances, the total length being approximately 52 miles, of which 7.5 miles will be of brick and concrete ranging from 4.75 ft. in diameter to 2x3 ft., egg shaped and laid at depths of from 12 to 20 ft. below the surface; and 43 miles will be of pipe sewers, from 8 to 24-in. in diameter laid at depths of from 5 to 18 ft. In addition to this there will be 6,500 ft. of 42-in. c. i. outfall pipe laid below the bed of the harbor on a pile foundation; also 650 ft. 24-in. flexible-joint c. i. pipe crossing Pasig River. J. F. Case, Ch. Engr., Dept. of Sewer & Water Wks. Construction.

Prosser, Wash.—B. E. McGregor, Town Clk., writes that the proposed sewerage system will cost about $4,000. Engineer, L. A. Clarke.

**West Allis, Wis.*—Forrestal & Downing are reported to have secured the contract for constructing a sewerage system in West Allis for $8,787.

Salt Lake City, Utah.—Geo. W. Riter, City Engr., is reported to be preparing to recommend to City Council the construction of 3 storm water sewers, from east to west.

BRIDGES.

Notes Arranged Alphabetically by States.

Ensley, Ala.—See "Railroads."

San Jose, Cal.—Bids will be received Oct. 3 by J. G. McMillen, County Surv., for the construction of a combination bridge on the Alviso and Milpitas Road, over Coyote Creek. It will have one span 120 ft.; approximate cost $4,500. Plans and specifications will be forwarded on receipt of $3.

Riverside, Cal.—It is stated that bridges will be received until Oct. 4 by the Bd. Superv. for constructing 4 cylinder piers for bridge across Santa Anna River. W. W. Phelps, Co. Clk.

**Hartford, Conn.*—Edwin D. Graves, Ch. Engr., Bridge Comn., writes that the contract for rubble granite walls, about 5,000 cu. yds. (bids opened Sept. 19) has been awarded to A. L. Hills, 720 Main St., for $38,625.

Washington, D. C.—The following are the bids opened on Sept. 16 by the Comrs., D. C., for constructing a concrete bridge at 16th St.: Penn Bridge Co., Beaver Falls, Pa., $42,731; Stacy B. Opdyke, Jr., 341 W. 23d St., New York, N. Y., $44,670; R. J. Beall Constr. Co., 1217 F St. N. W., Washington, $47,774; Abbott-Gamble Co., 32 Bway, New York, N. Y., $51,500; Tucker & Vinton Corporation, 156 5th Ave., New York, N. Y., $53,800.

Cairo, Ill.—There is some talk here of constructing a bridge over Mississippi River at or below this place, but at this time things are only in the shape of vague rumors. R. A. Hatcher is City Clk.

South Bend, Ind.—The County Comrs. have approved the plans of Alonzo J. Hammond, of South Bend, for removing Jefferson St. truss bridge to Spring Brook Park and building new concrete piers and abutments; estimated cost $25,000. John W. Harbon, County Aud.

**Franklin, Ind.*—The Bd. of County Comrs. is stated to have awarded to the National Bridge Co., of Indianapolis, the contract for the S. Main St. bridge over Young's Creek at $6,874.50. The bridge is to be reinforced concrete, 2 arches each, 57 ft. span, with 24 ft. driveway paved with brick pavement.

Peru, Ind.—It is stated that bids will be received until Oct. 2 by the Co. Comrs. for constructing several steel and concrete bridges in the county. C. W. Macy, Co. Aud.

**Hersey, Mich.*—L. B. Curtis, Township Clk., writes that the contract for constructing a bridge across Muskegon River has been awarded to the King Bridge Co., of Cleveland, O., for $6,500.

Tunica, Miss.—It is reported that bids will be received until Oct. 2 by the Bd. Co. Superv. (F. L. Hope, Clk). for constructing a bridge across Willough Slough, to be 100 ft. long.

Omaha, Neb.—See "Railroads."

Camden, N. J.—Bids will be received until Oct. 30 for constructing a bascule trolley and highway bridge across Cooper's Creek at Camden. J. J. Albertson, Co. Engr.

New York, N. Y.—The Bd. of Estimates at its meeting Sept. 14, is reported to have authorized the following appropriations: $500,000 for beginning the work on the construction of the subway terminal at the Manhattan end of Williamsburg Bridge; $175,000 for acquiring necessary land and constructing a new bridge across Dutch Kills Creek on Borden Avenue, in Boro. of Queens, and $250,000 for the completion of the Pelham Bay Bridge, over East Chester Bay in the Boro. of the Bronx.

Barberton, O.—Plans are stated to have been submitted to the City Engr. by the Erie R. R. Co. (Francis Lee Stuart, Ch. Engr., New York) for the Cornell St. viaduct. The estimated cost of the structure is $64,000.

Cleveland, O.—Bids will be received until Sept. 27 by the Bd. Pub. Service for constructing a concrete bridge on Beulah St. over Dugway Brook; also Sept. 28 for constructing a concrete bridge on Crawford Road over Dugway Brook.

Troy, O.—It is stated that bids will be received until Sept. 30 by the Co. Comrs. for constructing the superstructure of a high truss steel bridge across Stillwater River. E. E. Pearson, Co. Aud.

Jefferson, O.—It is reported that bids will be received until Oct. 7 at the office of P. C. Remick, Co. Aud., for furnishing materials and constructing a reinforced concrete bridge on N. Chestnut St.

Cleveland, O.—Bids will be received until Oct. 7 by Julius C. Dorn, Clk. Bd. Co. Comrs., for $28,000 Petrie Road Bridge bonds.

**Delaware, O.*—F. D. King, City Clk., writes that the

Items marked thus give the names of parties awarded contracts.

contract for the construction of a bridge over Delaware Run (bids opened Sept. 15) has been awarded to L. B. Denison, of Delaware, for the superstructure and to the Western Reserve Constr. Co., for excavation and substructure.

Guthrie, Okla. Ter.—It is stated that bids will be received until Oct. 2 by M. Trapp, Co. Clk., for furnishing the material for the superstructure of 16 steel bridges, 1 set of channel legs, 9 floor beams and about 3,000 lbs. of metal for repairs.

Stillwater, Okla. Ter.—It is stated that bids will be received until Oct. 11 by J. H. Donart, Co. Clk., for constructing 6 steel bridges.

Barton, Ore.—The County Court is stated to have opened on Sept. 9 bids for constructing a bridge over Clackamas River as follows: Payn, Counsel & Thomas, $14,275; C. T. Royal & Son, $12,700; Puget Sound Bridge & Dredging Co., $13,980; Burrell Constr. Co., $13,320; the International Contract Co., $13,397, and the Portland Bridge & Bldg. Co., $12,500.

**Apollo, Pa.*—McMenamin & Sims, of Philadelphia, are stated to have received the contract for constructing a railroad bridge over the Kiskiminetas River between Apollo and Paulton, for about $54,000.

Swissvale, Pa.—The Burgess of Swissvale is stated to have signed an ordinance providing for the construction of 2 under-grade crossings and 2 bridge crossings over the Pennsylvania R. R. tracks and does away with all crossings at grade, probable cost of improvements, $182,000.

Pittsburg, Pa.—See "Railroads."

Flandreau, S. D.—Bids will be received until Oct. 6 by the Bd. Co. Comrs. for furnishing materials and constructing all the bridges required in this county for 1 year from date of contract; Asa Loucks, Co. Aud.

Midland, S. D.—Bids will be received until Oct. 6 by M. P. Kennedy, Co. Aud., Ft. Pierre, for constructing a bridge across Bad River at Midland.

**Norfolk, Va.*—The contracts for building the bridges of the Tidewater R. R. Co. across the eastern and southern branches of the Elizabeth River are stated to have been awarded as follows: The contract for the eastern branch bridge to the McClentic Marshall Co., of New York, N. Y.; the Virginia Bridge and Iron Co., of Roanoke, the contract for the southern branch bridge.

*Bates & Rogers, of Chicago, Ill., are stated to have received the contract for the piers of these bridges. Sanford & Brooks, of Baltimore, Md., are stated to have received the contract for the pile driving for the piers.

**Aberdeen, Wash.*—The Pacific Bridge Co., of Portland, Ore., is stated to have received the contract for constructing a steel bridge at Heron St., for $27,625.

Spokane, Wash.—The City Council is stated to have decided to appropriate $6,000 toward the construction of the third Howard St. Bridge. The cost of the structure to be about $14,000.

Bids will be received until Sept. 29 by the Bd. Co. Comrs. (Z. Stewart, Clk.) for constructing a 150-ft. trestle, known as No. 71.

Manitowoc, Wis.—John Geist, of Milwaukee, recently appointed to examine the bridge at 10th St. is stated to have in his report to Council recommended the construction of a new structure, at a cost of $60,000.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—The City Council is stated to have passed an ordinance providing for the paving of a portion of 5th Ave.

San Francisco, Cal.—The Bd. of Supervisors is stated to have decided to pave with asphalt on a concrete foundation a portion of Van Ness Ave., at a cost of $30,000; also the roadway of a portion of California St. with bituminous rock, at a cost of $9,000.

Pueblo, Colo.—See "Sewerage and Sewage Disposal."

Wilmington, Del.—Francis A. Price, State Highway Comr., writes that the following are the bids opened on Sept. 19 for building a macadam road about 2 miles in length. Stewart & Donohue, Wilmington, $17,780, and Williamson & McLaughlin, Inc., 914 Lippincott Bldg., Philadelphia, Pa., $16,336.

Washington, D. C.—Bids will be received until Oct. 14 for laying cement sidewalks in the District of Columbia, as advertised in The Engineering Record.

**Boise, Idaho.*—E. B. Darlington, Engr. Mountain Road Comn., writes that Chas. Storey, of Boise, has secured the contract for constructing 27 miles of mountain road, including 2 wooden bridges (bids opened Sept. 9) for $26,400.

Mound City, Ill.—Bids will be received until Sept. 30 by Maj. Thos. Cruse, D. Q. M., U. S. A., St. Louis, Mo., for repairing road to Mound City National Cemetery.

Chicago, Ill.—Bids will be received until Sept. 26 by the Bd. Local Improv. (And. M. Lynch, Pres.) for grading and paving with granite blocks, portions of alleys.

Crownpoint, Ind.—It is stated that bids will be received until Oct. 7 by the Co. Comrs. for constructing about 11 miles of gravel roads in Hobart Township and a 2-mile gravel road on the county line. Saml. A. Love, Chmn.

Terre Haute, Ind.—The Bd. of Wks. is stated to have opened bids as follows for paving *a* portion of Locust St.; *b* a portion of Ohio St.: Grant-Forbs Co., *a* $39,000, *b* $4,100; Roberts & Co., *a* $38,000, *b* $3,900; Fred C. Merideth, *a* $35,900; Voorhees & Son, *a*, $38,000, *b* $3,500, and Jesse Robertson, *a* $43,740, and *b* $4,886.

South Bend, Ind.—Bids will be received by the Bd. of Pub. Wks. (W. A. McInerney, Pres.) until Sept. 26, for paving with brick Tutt St., 2,300 sq. yds., and one alley, 433 sq. yds.

A resolution has been adopted by the Bd. of Pub. Wks. for paving Ashland Ave. and Rex St. with brick.

**Osceola, Ia.*—W. N. Temple, City Clk., writes that the Miracle Pressed Stone Co., of Des Moines, has secured the contract for about 20,000 sq. ft. cement walk at 11 cts. per sq. ft. and for curbing 29 cts. per lin. ft.

**Boston, Mass.*—Contracts have been awarded as follows (bids opened Sept. 14 by the Massachusetts Highway Comn.) For road at Roxborough, Mass., to Bruno & Milano, 293 North St., Boston, $4305; for road in Whately to Amos D. Bridge, Hazardville, Conn., for $4,931, and for road at Templeton, also to Amos D. Bridge, for $3,852.

Jackson, Mich.—Bids will be received until Oct. 2 for furnishing material and paving 1st St., Park Ave., Elizabeth St. and Michigan Ave. with brick, asphalt block, bitulithic, sheet asphalt of bituminous macadam, as advertised in The Engineering Record.

**Duluth, Minn.*—P. McDonnell, of Duluth, is stated to have secured the contract for paving 5th Ave. W. with sandstone and with cedar block (bids opened Sept. 8) for $4,509.

Crookston, Minn.—J. E. Carroll, City Engr., writes that P. McDonnell, of Duluth, bid on Sept. 12 for paving Robert St. with creosote block, 2,709 sq. yds. (4 bids) $2.75 to $3 per sq. yd. and 1,063 lin. ft. sandstone curb, 80 cts. and $1.20 per lin. ft.

New York, N. Y.—The Bd. of Estimate on Sept. 14 is reported to have authorized an appropriation of $300,000 for street paving and sewer construction, and $25,000 for a parkway in Delancey St., Manhattan Boro.

New York, N. Y.—Bids will be received until Sept. 26 by Louis F. Haffen, Pres. Boro. Bronx, for regulating, grading and building steps, etc., in a portion of Belmont St. Engineer's estimate: 440 cu. ft. new granite steps, furnished and set; 410 cu. ft. new granite coping and newels, furnished and set; 260 lin. ft. new curb; 250 sq. yds. granolithic pavt.; 100 cu. yds. rubble masonry in mortar, etc.

Bids will be received until Sept. 28 by John F. Ahearn, Boro. Pres., for regulating, grading, curbing, paving, repaving, etc., portions of numerous streets. Engineer's estimate: 63,681 sq. yds. wood block pavt.; 75,870 sq. yds. asphalt pavt., including binder course; 6,660 sq. yds. new granite block pavt., including sand bed, laid with paving cement joints; 1,420 sq. yds. asphalt block pavt.; 38,285 lin. ft. new bluestone curb, furnished and set; 11,317 lin. ft. new curb, furnished and set; 65,122 sq. ft. new flag, to furnish and lay; 11,838 cu. yds. concrete, including mortar bed; 3,130 cu. yds. concrete, 3 in.; 37,922 cu. yds. rock excav.; 11,805 cu. yds. earth excav.; 184 noiseless covers, complete for sewer manholes, furnished and set; 139 noiseless covers, complete, for water manholes, furnished and set, etc. Boro. Manhattan.

**Rochester, N. Y.*—The contract for paving with block stone on Mortimer St. is reported to have been awarded to Geo. W. Hagaman Co., for $4,308.

Buffalo, N. Y.—It is stated that bids will be received until Sept. 29 by Francis G. Ward, Comr. Pub. Wks., for paving on Clare, Bond and Oneida Sts.

Columbus, O.—Bids will be received until Oct. 4 by the Bd. Pub. Service (Chas. H. Frank, Secy.) for grading, curbing and paving portions of several streets with hard-burned brick or block, macadam or other substantial material.

Dayton, O.—It is reported that bids will be received by the Bd. Pub. Service (Wm. F. Miller, Clk.) until Sept. 29 for paving a portion of Oak St.

**Toledo, O.*—Russell & Jennison are stated to have received the contract for repaving with Kreodone wood block portions of Summit and Galena Sts., for about $105,118.

**Clyde, O.*—Geo. Kinney, of Fremont, is stated to have received the contract for paving Amanda St., at a cost of about $8,000.

**Fayette, O.*—M. T. O'Sullivan, of Toledo, is stated to have reecived the contract for paving Main and Fayette Sts. with Logan block at $4,940 and $7,236, respectively.

Paving bonds amounting to $16,000 are reported sold.

Norwalk, O.—It is stated that bids will soon be received for paving with brick a portion of E. Main St.

**Ottawa, O.*—O. C. Talbot, County Surveyor, writes that M. P. Goetschins, of Ottawa, has secured the contract for constructing the A. M. Wiseley Road, 10¼ miles in length (bids opened Sept. 16), for $45,567, and J. R. Holran, of Fostoria, for the W. G. Brugman Road, 5 miles in length, for $18,689.

Cincinnati, O.—Bids will be received until Sept. 26 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing materials and improving a portion of Daindridge St., by grading, curbing and paving with bowlders; also same date on a portion of Lytle St., with bitulithic pavement; also Oct. 10 for paving with bitulithic on a portion of Pearl St.

The Bd. of Pub. Service is stated to have rejected all bids received Sept. 5 for paving with bitulithic on a portion of Celestial St., being in excess of the appropriation.

The following bids are stated to have been opened Sept. 5 by the Bd. Pub. Service for paving with bitulithic a portion of Mound St.: Kirchner & Co., $2.49⅓; Henkel & Sullivan, $2.62⅓, and Warren Bros., $2.65½.

**Chillicothe, O.*—H. M. Redd, City Engr., writes that the contract for paving 2d and Main Sts. with brick, 9,200 sq. yds. (bids opened Sept. 12) has been awarded to W. H. Ringwald, of Chillicothe, for $16,276.

Doylestown, Pa.—Bids will be received until Oct. 3 by the State Highway Dept., Harrisburg (Jos. H. Hunter, Comr.), for constructing 28,179 ft. of road in Bucks Co.

**Mercer, Pa.*—J. M. Campbell, City Clk., writes that the following are the bids opened on Sept. 6 for furnishing 400,000 paving brick (*a*) vitr. fire clay paving brick, (*b*) repressed block: (price given per M): J. M. Porter, Pittsburg, *a* $9.75, *b* $15.50; Mack Mfg. Co., Pittsburg, *a* $11.10, *b* $18.10; American Sewer Pipe Co., Pittsburg, *a* $9.35; Pennsylvania Clay Co., Rochester, *a* $9.20 (awarded contract); Metropolitan Paving Brick Co., Canton, O., *a* $11.75; Layton Fire Clay Co., McKeesport, *a* $11.50, *b* $16.95; Mahoning Supply Co., Youngstown, O., *a* $9.50; Pittsburg & Buffalo Co., Pittsburg, *a* $11.75, *b* $16.95.

**Greensburg, Pa.*—Bowman Bros., of McKeesport, are stated to have received the contract for improving portions of Pennsylvania Ave. and 4th St., at $9,735.

York, Pa.—The West York Borough Council is stated to have decided to macadamize a portion of W. King St. in West York.

**Memphis, Tenn.*—The Nashville Roofing & Paving Co. is stated to have received the contract (bids opened Sept. 7) for removing 21,000 granite blocks and repaving with asphalt.

Galveston, Tex.—The lowest bids opened Sept. 13 by the Bd. City Comrs. is stated to have been submitted by W. I. Heffron, for Market St., at $5,926 and F. O. Brown for 25th St., at $6,914.

El Paso, Tex.—The City Council is stated to have decided to issue $175,000 bonds for paving all the business streets.

Ft. Monroe, Va.—Bids will be received by Capt. R. H. C. Kelton, Constr. Q. M., U. S. A., until Sept. 30, for constructing concrete walks and paving service roadways.

Moundsville, W. Va.—Bids will be received until Oct. 18 at the office of Walter A. McGlumphy, City Clk., for paving with vitr. brick, a portion of 8th St.

Stoughton, Wis.—It is stated that bids will be received until Oct. 7 by W. H. Linderud, City Clk., for improving Main St.

**Vancouver, B. C.*—The contract for paving Hastings St. is stated to have been awarded to the Independent Asphalt Co., of Seattle, Wash., for $20,000.

POWER PLANTS. GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Roosevelt, Ariz.—Bids will be received until Nov. 2 by O. H. Ensign, Electrical Engr., 398 Pacific Electrical Bldg., Los Angeles, for furnishing complete f. o. b. bidder's works, one or more 1,260-h.p. water wheels and one or more 140-h.p. water wheels, with gate valves, pipe connections and governors, for use at the Roosevelt power house, Salt River Project, Ariz.

Oroville, Cal.—The Oro Water, Light & Power Co. is reported incorporated, with a capital of $3,500,000, to manufacture and generate power, etc. Incorporators: J. A. Kretschmer, R. C. Medcraft and others. This is reported to be a combination of the Oroville Light & Power, the Oroville Water, Lava Beds Dredging and Marigold Dredging Companies.

Rockvale, Colo.—The Council is reported to have granted the Arkansas Valley Electric Light Co. a franchise to construct and operate an electric light plant.

Bristol, Conn.—The Bristol & Plainville Tramway Co. is reported to be considering the construction of a gas plant.

Washington, D. C.—Bids will be received until Oct. 3 at the Bureau Supplies and Accounts, Navy Dept., Washington, to furnish at the navy yards, etc., Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Washington, D. C.; Norfolk, Va., and Charleston, S. C., a quantity of naval supplies, as follows: Electrical supplies; battery cells; steel conduit; Portland cement; water-tube boiler; sheet iron; bar steel; cable iron, etc.; also Oct. 10, to furnish at the navy yards, Pensacola, Fla., and the naval stations, Key West, Fla., and New Orleans, La., a quantity of supplies, as follows: Incandescent lamps; conduit fittings; copper sheeting; bar iron; steel angles and plates; rivet steel, etc.; also same date, to furnish at the navy yard, New York, N. Y., and the works of the Fore River Shipbuilding Co., Quincy, Mass., the New York Shipbuilding Co., Camden, N. J., and the Newport News Shipbuilding & Dry Dock Co., Newport News, Va., a quantity of elevating, rammer and ammunition hoist, electric equipment. H. T. B. Harris, Paymaster-Gen., U. S. N.

Key West, Fla.—An ordinance is stated to have passed first reading, granting to Messrs. Ladd. Larkins and Jerguson, a franchise to furnish electric light to Key West.

Rockmart, Ga.—The Rockmart Electric Light, Power & Water Co. is reported to have decided to petition Council for a franchise to construct an electric light plant. A. H. Graefer, Secy.

**La Grange, Ga.*—Contracts for constructing the municipal electric light plant (bids opened Sept. 15) have been awarded as follows: Two boilers and stack to Lombard Iron Wks., of Augusta; 2 engines to Ball Engine Co., of Erie, Pa.; 2 generators to Crocker-Wheeler Co., Ampere, N. J.; switchboard and arc lamps to Westinghouse Electric & Mfg. Co., Pittsburg, Pa., and pole line and wiring to Ryan Constr. Co., of Indianapolis, Ind. Building, piping and foundations not yet let. Roy Dallis, City Engr.

Chicago, Ill.—Bids will be received until Oct. 5 by M. C. Martin, Ch. Q. M., U. S. A., for furnishing and delivering at this city 55,000 incandescent electric lamps.

Separate bids will be received by Wm. Carroll, City Electrician, until Sept. 27 for furnishing and installing apparatus and equipment approximately as follows: 1 vertical, cross-compound condensing engine of 1,100 hp.; 1 water-tube boiler; 1 furnace and smoke-consuming device; 1 mechanical stoker and smoke-consuming device; turbo-generator and direct-connected unit and accessories; also informal proposals for 3 furnaces with smoke-consuming devices.

Richmond, Ind.—The Council is reported to have granted the Ohio & Indiana Consolidated Gas Co. a franchise to supply the city with gas.

Afton, Ia.—The Council is reported to be considering the question of constructing a municipal electric light plant, or of granting a franchise for the plant.

Hopkinsville, Ky.—John H. Bell, Jr., of Hopkinsville, is stated to have secured a franchise for the construction and operation of an electric railway and electric light plant.

Saginaw, Mich.—The Rifle River Power Co., of Saginaw, has employed H. von Schon, Wayne County Bank Bldg., Detroit, to examine and report on the development of Rifle River, Mich.

Muskegon, Mich.—The Grand Rapids & Muskegon Water Power Electric Co. is reported to have secured a franchise to erect poles and string wires through Muskegon Heights.

L'Anse, Mich.—Plans are reported to have been completed for the construction of a municipal electric light plant.

**Willmar, Minn.*—J. T. Otos, City Clk., writes that W. I. Gray & Co., of Minneapolis, have secured the contract for an engine, 120-kw. alternator, and steam and electrical appliances for the addition to the water and electric light plant (bids opened Sept. 11) for $5,300.

Helena, Mont.—We are informed by the Helena Power Transmission Co. that practically all its large contracts have been let.

New York, N. Y.—Bids will be received until Oct. 3 by the Bd. Health (Thos. Darlington, M. D., Pres.) for furnishing material and installing electric and gas lighting fixtures in the administration and laboratory buildings, and the scarlet fever pavilion on the grounds of the Willard Parker Hospital, Boro. Manhattan.

Cairo, N. Y.—C. E. Hewitt & Co., Park Row Bldg., New York, have closed a contract with the Ambursen Hydraulic Constr. Co., of Boston, Mass., for a concrete-steel dam 27 ft. high and 210 ft. long, on Catskill Creek, near Cairo. The dam is to be completed by Dec. 1st.

**South Glens Falls, N. Y.*—The Bd. of Village Trus. is reported to have awarded the United Gas, Electric Light &

Items marked thus give the names of parties awarded contracts.

Fuel Co. the contract to light the village streets for 5 yrs., with 2,000-c.p. arc lights, at $50 per light per yr.

Louisburg, N. C.—The question of constructing a municipal electric light plant is reported under consideration here.

Salem, O.—E. E. Beam, of Cleveland, and S. D. Gilbert, of Cincinnati, are reported to have purchased the plant of the Salem Light & Power Co., and will rebuild and enlarge the plant.

Pawhuska, Okla. Ter.—The Pawhuska Electric Light, Ice & Water Co. is reported incorporated with a capital of $25,000 by J. W. McCloud, of Little Rock, Ark. W. C. Tucker, of Pawhuska, and others.

Lancaster, Pa.—The directors of the Edison Electric Illuminating Co. and the Lancaster Gas Light & Fuel Co. are reported to have awarded to the Providence Engine Co., of Providence, R. I., the contract for enlarging the electric light plant at Engleside, for $165,000; also to the United Gas Co., of Philadelphia, the contract for constructing a new gas plant for $100,000.

Ft. Monroe, Va.—Bids will be received until Oct. 16 by Capt. R. H. C. Kelton, Quartermaster, for furnishing and installing the fixtures for electric lighting in 30 sets bachelors' quarters, 3 double sets officers' quarters and the post exchange and gymnasium building at Ft. Monroe.

Cashmere, Wash.—Mr. Farnum is reported interested in the construction of a water power and electric plant at Cashmere.

Chinook, Wash.—The Chinook Light, Power & Water Co. is reported incorporated, with a capital of $10,000, by Albion L. Gile and others.

Spokane, Wash.—The Spokane-Palouse Light & Power Co. is reported incorporated with a capital of $100,000 by W. E. Goodspeed, B. H. Kiser and others.

Seattle, Wash.—The city officials are reported to be considering the installation of another unit at the municipal electric light plant, at a probable cost of $15,000.

An ordinance has been introduced in Council granting the Seattle-Tacoma Power Co. permission to install and operate a steam heating and power service, to all of the first hill not now covered by existing franchise.

Port Townsend, Wash.—The City Council is reported to have received an application from W. A. Pfeiffer for a franchise to construct and maintain an electric light and power plant in connection with a gas plant.

Hartland, Wis.—The citizens voted Sept. 11 to issue $7,000 bonds for installing a gasoline gas plant. H. W. Goodwin, Village Pres.

Milwaukee, Wis.—The Finance Com. of Council on Sept. 13 adopted a resolution, providing that $60,000 be set aside from the water fund to purchase a site for the municipal lighting plant.

Provo, Utah.—W. E. Harding, City Recorder, writes that it is proposed to construct water works and an electric light plant, at a cost of $91,000. Engineer, Frank C. Kelsey, Salt Lake City.

Toronto, Ont.—The Georgian Bay Power Co., of Toronto, has engaged H. von Schon, Wayne County Bank Bldg., Detroit, Mich., to plan development on Eugenia Falls on Beaver River, Ont., where a head of about 400 ft. will be available.

Westmount, Que.—The Robb Eng. Co. is reported to have secured the contract for the engines, accessories and their erection in connection with the new electric light plant for $8,300. The Custodis Chimney Constr. Co. secured the contract for building the chimney for the plant, at $6,250.

Vancouver, B. C.—It is reported that the estimated cost of constructing a municipal plant has been placed at $500,000.

Para, Brazil.—See "Electric Railways."

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Bessemer, Ala.—The Birmingham Ry., Light & Power Co. is reported to have in contemplation the construction of a line to Jonesboro.

Birmingham, Ala.—The Birmingham Ry., Light & Power Co. (Robt. Jemison, Pres.) is reported to have announced that an electric car line will be built to Boyles, 4 miles from the city. The estimated cost of the line will be about $40,000.

Napa, Cal.—The Vallejo and Napa Valley Electric Ry. Co. is stated to have decided to extend its lines from Napa Valley up into Lake County. Preparations are already under way and rights of way have been secured for extending the electric road from Napa to St. Helena and Calistoga, and some of the track has been laid between Napa and St. Helena. As soon as this work has been completed and the electric road is in operation in this valley the line will be extended from Calistoga into Lake County.

The Napa & Lakeport Ry. Co. is reported incorporated to build an electric railway from Napa to Lakeport. Capital, $2,000,000. E. C. Amadee and A. J. Brown, of this city, and F. W. Ansell are the incorporators. The road will be 90 miles long and will have a branch from Napa to Monticello. The road will parallel the California Northwestern for many miles.

Telluride, Colo.—The County Comrs. are reported to have granted a franchise to S. H. Blair, of Telluride, and J. J. Henry, of Denver, for the construction and operation of an electric railway from Telluride to the Smuggler-Union and the Tomboy mines.

Dover, Del.—The Kent County Levy Court is reported to have granted a right of way to the Smyrna, Kent County & Delaware Bay Traction Co.

Jacksonville, Fla.—The County Comrs. are stated to have granted the Jacksonville Suburban & Seashore R. R. Co. the right to construct, maintain and operate an electric railway.

Georgetown, Ga.—The Wynyah Traction & Power Co., which proposes to build an electric railway to Georgetown, 6 miles long, is reported incorporated. Incorporators: J. B. Steele, W. W. Taylor, E. W. Kaminsk, W. H. Andrews, L. Mouzon, all of Georgetown.

Atlanta, Ga.—The Atlanta & Carolina Constr. Co. is stated to have received a franchise to build an electric railway from a point on the Flat Shoals public road to the corporate limits of the city of Atlanta. Dr. H. L. Wilson, Pres.; I. E. Wilcox, Treas., and M. Thomas Edgerton, Secy.

Lewiston, Idaho.—A contract for the construction of 24 miles of the Lewiston & Southeastern Electric Ry., from Lewiston to Grangeville, is stated to have been secured by Naylor & Norlin, of Lewiston, and work will be begun soon.

Alton, Ill.—The Alton, Jacksonville & Peoria Ry. Co. is stated to have accepted the franchise granted in North Alton, by which it agrees to pave the streets over which it passes and to maintain electric lights on the same streets.

East St. Louis, Ill.—Hartman & Co. have secured the contract for grading the Illinois & Indiana Ry., between East St. Louis and Belleville. W. J. Crocken, Engr. in charge.

Jacksonville, Ill.—The Illinois Western R. R. Co. is stated to have decided to build an electric railway from Jacksonville to Springfield, a distance of 33 miles.

Evansville, Ind.—The City Council is stated to have granted a franchise to the Evansville & Mt. Vernon Traction Co.

Warsaw, Ind.—The Electrical Installation Co., Monadnock Bldg., Chicago, Ill., is stated to have been awarded the contract for the complete construction and equipment of the Warsaw-Goshen line of the Winona Interurban Ry. Co.'s system. The contract calls for an expenditure of $600,000 to $700,000.

South McAlester, Ind. Ter.—The Washita Valley Interurban Electric Co., of Tishomingo, is reported incorporated, with a capital of $12,000,000, by W. T. Croslan, J. G. V. Redmon and M. R. Morris, to build an electric interurban railway from Shreveport, La., through Texas, Indian Territory and Oklahoma to Anadarko.

Evansville, Ind.—Articles of incorporation are stated to have been filed by the Indianapolis, Vincennes & Evansville Electric Ry. Co. It is proposed to connect Evansville, Vincennes and Indianapolis and intervening towns. Capital, $100,000. Incorporators: Z. B. East, J. L. Ebner, W. A. Cullop and others.

Peru, Ind.—The Winona Interurban Co. announces that the work on the line between Peru and Warsaw will begin at once. The company has also leased the Peru-Chili line of the Wabash, which will be electrified and placed in service.

Hopkinsville, Ky.—See "Power Plants, Gas and Electricity."

Hagerstown, Md.—The Hagerstown & Waynesboro Electric Ry. Co. is reported incorporated with a capital of $100,000, for the purpose of building an electric railway between Hagerstown and Waynesboro, Pa., a distance of 11 miles. Mayor A. C. Strite, D. Clayton Gilbert, Walter D. Willson, Dr. E. A. Wareham and John W. Feldman, all of Hagerstown, are reported interested.

Kalamazoo, Mich.—An ordinance is stated to have been passed granting a franchise to the Kalamazoo, Lake Shore & Chicago Traction Co.

Marshall, Mo.—The City Council is stated to have granted the Central Electric Ry. Co. right of way to locate and operate an electric railway through the city. The line proposed will run from Sedalia north to Miama.

Sedalia, Mo.—A certificate of incorporation is reported to have been granted to the Central Ry. Co., of Sedalia. The capital is $1,500,00.

St. Louis, Mo.—The St. Louis, Fern Ridge & Western Ry. Co. is stated to have filed a petition for a franchise at Clayton, Sept. 14. They intend building a road, starting at De Hodiamont, and following the Olive St. road to Studt's Park, Creve Coeur Lake. Wm. Pfister, of Creve Coeur Lake, Pres.

Omaha, Neb.—The Union Pacific R. R. Co. and the Omaha & Council Bluffs St. Ry. Co. are reported to be having engineering corps in the field locating new lines at South Omaha. The Union Pacific is locating a cut-off line between South Omaha and Elkhorn. The Street Ry. Co. is locating its new line between South Omaha and Ft. Crook. The Union Pacific cut-off from South Omaha to Elkhorn will be 18 miles long. The street railway engineering corps will locate the route of the new line to Ft. Crook. It will take several weeks to do this work, and then it is proposed to commence the construction of the line. It will be an extension of the Albright line, and it is probable that cars on the new line will run between South Omaha and Ft. Crook.

New York, N. Y.—The Manhattan & Long Island R. R. Co., of New York, is reported to have been incorporated at Albany Sept. 15 with a capital of $10,000,000, to operate an electric road 80 miles long in Greater New York and on Long Island, the terminals to be in Long Island City and at Northport. Directors: Edw. Mackey, D. T. Meyer, H. H. Bowtell, of New York; Robt. M. Stockwell, Yonkers; A. Parontand, Brooklyn, and Henry Guinard, Watchung, N. J.

Cleveland, O.—Bids will be received until Oct. 3 by the Bd. Pub. Service (A. R. Callow, Secy.) for furnishing materials, grading and constructing about 1½ miles of electric railway from Kinsman St., south to the Cleveland Farm Colony.

Shelby, O.—The Plymouth & Shelby Traction Co., with a capital of $200,000, is reported incorporated by H. B. Avery, Sherman Culp, G. L. Rebman, Frank L. Scott and Sterling Parks, of Cleveland. The promoters are at the head of the Sandusky, Norwalk & Mansfield Railway Company, which at present operates a line from Norwalk to Plymouth. The incorporation of the new company indicates that they propose to extend the line from Plymouth to Shelby, where connection will be made with the Shelby-Mansfield line for Mansfield.

Pittsburg, Pa.—The Pittsburg Rys. Co. is stated to have decided to extend its Charleroi line from the present terminus to Allenport to West Brownsville, a distance of 10 miles. The company has been having surveys made for the route between Allenport and West Brownsville, and reports of the survey work are about complete.

Pittsburg, Pa.—Private right of way is stated to have been practically secured for the Shenango St. Ry. Co. This line will be 65 miles long and will connect New Castle, Sharon and other Shenango Valley points with Conneaut Lake, Meadville and Cambridge Springs, a distance of 150 miles. W. H. Waugh, Ch. Engr., 338 2d Ave., Pittsburg, Pa.

Cambria, Pa.—The Blair & Cambria St. Ry. Co. is reported to have filed notice of the intention to apply for a charter. Incorporators: H. P. Wilson, F. D. Wray, W. S. Lee, W. B. Douglass, F. J. Thompson, James Malone and F. G. Patterson. The route they propose to cover is from the city of Altoona to the "Buckhorn," thence to Asheville, where they propose to cross the C. & C. steam tracks, to a point about a mile from Chest Springs, to Patton, the Cambria County terminus. A branch is also proposed from Buckhorn to Wopsonock.

Harrisburg, Pa.—Charters are stated to have been granted at the State department to the following electric street railway companies:

Ambridge & Boden Ry. Co.; capital, $12,000, to build 1⅝ miles of line, all double track, over the streets of Boden. Dir.: W. E. Guy, H. P. Barnes, T. T. Aldrich, H. I. Reed, A. O. Bates, all of Pittsburg and Allegheny.

Economy & Harmony Ry. Co.; capital, $18,000, to build 3 miles of line from Ambridge to the Beaver-Allegheny County line. Dir.: Wm. A. Park, Jno. H. Park, James M. Beal, John Warren and Geo. I. Park.

Freedon & Baden Ry. Co.; capital, $6,000, to build ¾ mile of line from Baden to Conway. Dir.: John H. Park, W. A. Park, James M. Beal, Chas. Connel and Geo. I. Park.

Brownsville Ry. Co.; capital, $24,000, to build 4 miles of line over the streets of Brownsville. Dir.: Holman R. Lynn of Pittsburg, Milton J. Eakin, Byron E. Horis, Daniel B. Ludwick, William B. Dunbar.

Bridgeport Ry. Co.; capital, $24,000, to build 4 miles of line over the streets of Bridgeport. Dir.: Holman R. Lynn of Pittsburg, Milon J. Eakin and others.

Tacoma, Wash.—Engr. L. A. Nicholson is stated to have estimated the cost of building the Puyallup Electric Ry. He states that the expense, not including equipment, for the 9½ miles of track will be about $127,000. Right of way has been obtained practically all the distance. Officers for the company: Fred. J. Chamberlain, Pres.; John Mills, Secy.; W. H. Elvins, Treas.

Para, Brazil.—The London branch of the firm of J. G. White & Co., of New York, N. Y., is reported to have secured the contract for an electric traction and lighting system, to cost about $2,000,000. It is reported that the existing mule and steam lines, operated by the Compania de Estrado de Ferro Pareanse, are to be equipped with electric motive power.

RAILROADS.

Notes Arranged Alphabetically by States.

Ensley, Ala.—C. D. Smith & Co., of Birmingham, are reported to have secured the contract for constructing 4 miles of railroad for the Ensley Southern R. R. The contract is reported to include heavy side hill rock work and a 600-ft. tunnel and bridge across Little Warrior River. The remaining 5 miles of the proposed extension between Short Creek and Parish, it is said, will shortly be let.

San Diego, Cal.—The Bay Shore & Pacific R. R. Co. is reported incorporated, with a capital of $2,000,000, to construct and operate a railroad in San Diego. Directors: H. T. Richards and C. R. Hammond, of San Diego; M. H. Rogers, Denver, Col., and others.

Denver, Colo.—Press reports state that bids will shortly be called for the grading of the Denver, Northwestern & Pacific R. R. The construction of the road through the Gore Canon will cost about $4,000,000. David H. Moffat, of Denver, is reported to be the chief promoter.

Greenville, Ga.—The Central of Georgia Ry. is stated to have awarded the contract for building its extension from Greenville to Newnan, a distance of about 23 miles, to Oliver & Co., of Knoxville, Tenn.

Louisville, Ga.—It is stated that the Stillmore Air Line (G. M. Brinson, Pres., Stillmore, Ga.) is to be extended to Louisville.

Augusta, Ga.—The Augusta & Florida R. R. Co. is reported to have decided to extend its line from Keysville to Augusta, a distance of about 26 miles.

Christopher, Ill.—The Chicago, Burlington & Quincy R. R. Co. (T. E. Calvert, Ch. Engr., Chicago) is reported to have decided to begin soon the extension of the Southern Illinois lines. It contemplates construction of a line from Valier, north of Christopher, direct to St. Louis. The survey from Valier extends in a northwesterly direction through the counties of Franklin, Perry, Washington and St. Clair. The road will connect at Belleville with the St. Louis and O'Fallon Ry., which is to be extended to that point.

Atlanta, Ill.—The Atlanta & Lawndale R. R. Co. is reported incorporated, with principal office at Chicago; capital, $25,000. It is proposed to construct a line from Atlanta, in a southerly direction, to a point in section 36, township 21 north, range 2 west. Incorporators: Jas. Miles, Riverside, Ill.; Silas W. Strawn, Ralph M. Shaw and others, all of Chicago.

Ogelsby, Ill.—The Ogelsby & Granville Ry. Co. is reported incorporated with a capital of $250,000, to construct a line from the Vermillion River, near Portland, La Salle County, in a westerly direction, to Granville, Putnam County. Incorporators: S. T. Crapo, Detroit, Mich.; A. Uhrlaub, Albert G. Mang and others, all of Chicago. Principal office said to be at Chicago.

Pauls Valley, Ind. Ter.—A charter has been granted to the Pauls Valley R. R. Co., with a capital of $5,000,000, to construct a line beginning at a point on the K., K. & T. Ry. at or near Ada, I. T., thence southwest through the Ind. Ter., crossing the Gulf, Colorado & Santa Fe Ry. at Pauls Valley, and crossing the Rock Island R. R. at or near Waureka, and through Comanche County to Wichita Falls, Tex., a distance of 180 miles. J. C. Amendt, Pres., Chicago, Ill.; W. M. Freeman, Vice-Pres., Pauls Valley; Albert Rennie, Secy., Pauls Valley.

Sulphur, Ind. Ter.—The Gulf, Colorado & Santa Fe Ry. Co. (C. F. W. Felt, Ch. Engr., Galveston, Tex.) is reported to have under consideration the construction of a line to Sulphur.

Sebewaing, Mich.—People of Caro and Sebewaing are reported to be strongly agitating the extension of the Michigan Central Ry. (Geo. H. Webb, Asst. Ch. Engr., Detroit) from Owendale to Sebewaing.

Sedalia, Mo.—Chas. A. Gallagher, of Kansas City, is reported interested in the construction of a railroad from some point south of Sedalia on the Rock Island R. R. to Marshall and Miami, and north to connections in Iowa, a total distance of about 68 miles.

South Omaha, Neb.—It is stated that surveys are now being made by the Union Pacific R. R. Co. (John B. Berry, Ch. Engr., Omaha) for a cut-off between South Omaha and Lane, a station near Elkhorn. The new route is 18 miles long.

Omaha, Neb.—Press reports state that the Chicago, Milwaukee & St. Paul R. R. Co. (D. J. Whittemore, Ch. Engr., Chicago, Ill.) will make extensive improvements on its western lines to Omaha and will elevate its tracks at the Chicago terminals and double-track westward to the Missouri River. The bridge spanning the Mississippi at Savanna will be replaced by a larger structure. Contractor Jarvis, of Chicago, Ill., is reported to have secured the contract for the work.

Concord, N. H.—The City officials and the Boston &

**Items marked thus give the names of parties awarded contracts.*

Maine R. R. (W. F. Ray, Div. Supt., Concord, N. H.) are reported to be considering the abolition of grade crossings in connection with work proposed on the East Concord bridge.

**Raton, N. M.*—The contract for building the entire 120 miles of the St. Louis, Rocky Mountain & Pacific Ry. from Des Moines, N. M., on the Colorado & Southern Ry., westward to the Elizabethtown mining district is reported to have been awarded to the Utah Constr. Co., of Salt Lake City, Utah. The line will intersect the Atchison, Topeka & Santa Fe Ry. at Raton and the Dawson Ry. at Koehler, 4 miles south of Dawson. The specifications call for 80-pound rails, for which a contract is reported to have been placed with the Colorado Fuel & Iron Co.

Newark, N. J.—Track elevation bonds to the amount of $250,000 are reported to have been sold by city.

New York, N. Y.—Incorporation papers have been filed at Albany and Trenton by the Inter-State Tunnel Ry. Co., and its financiers and incorporators are reported to be the New York City Ry. Co. and the Public Service Corporation, of New Jersey. The purpose of the company is to construct a tunnel under the North River from Erie and 12th Sts., Jersey City, to Chambers St., bet. Bway and the Brooklyn Bridge terminal in Manhattan Boro. It is proposed to begin construction as soon as necessary rights of way have been secured. It is stated that an applicaion for necessary rights is to be made at once to the Rapid Transit Comn.

John F. Ahearn, Boro. Pres., is stated to have issued an order on Sept. 19, revoking the permit of the New York & Long Island R. R. Co. to open 42d St., near the East River to sink a shaft for tunneling to Long Island City.

Wellington, O.—The Wabash R. R. Co. (W. S. Newhall, Ch. Engr., St. Louis, Mo.) is reported to have decided to build a branch road from Wellington to Lorain, where a large sum will be expended upon dock facilities.

Oklahoma City, Okla. Ter.—G. B. Stone, a promoter of the Oklahoma & Texas R. R. Co., is reported to have announced that all funds necessary for the construction work have been secured.

Wilkinsburg, Pa.—Local press reports state that detailed plans for the abolition of grade crossings have been presented to the Boro. Council by the Pennsylvania R. R. Co. (W. H. Brown, Ch. Engr., Philadelphia) which contemplates the expenditure of $1,000,000 for the elevation of its tracks through the borough, and the construction of subways to replace the present grade crossings. The company will pay all cost of work, but asks borough to stand damages to private property, estimated at about $150,000.

Pittsburg, Pa.—Jos. Ramsey, Jr., of St. Louis, Mo., Pres. Wabash R. R., is reported as saying that arrangements have been made for the transfer of the Little Kanawha road to interests which will build a line through Greene Co. to a connection with the Buckhannon & Northern, now under construction.

The Wheeling & Lake Erie R. R. Co. (W. S. Newhall, Ch. Engr., Pittsburg) is reported to have decided to expend about $12,000,000 in improvements. Heavy grades and curves are to be eliminated, new bridges constructed and the line will be double-tracked.

Swissvale, Pa.—See "Bridges."

Knoxville, Tenn.—Maj. E. A. Wilson, of Knoxville, who was at the head of an engineering party, is reported to have returned to this city from a trip over the proposed route of the South & Western Ry.; the line will probably be 300 miles in length. It will be constructed into the coal fields of Virginia, through the mountains of East Tennessee and into the Carolinas. Considerable work, it is stated, has been done toward preparing a route for the proposed line between Spruce Pine, N. C., and Marion, and it is said that there will be 14 tunnels. Geo. L. Carter is the chief promoter.

Union City, Tenn.—A charter has been granted to the Union City & Reelfoot Ry. Co., with a capital of $100,000. Incorporators: R. P. Whitsell, J. C. Burdick, T. B. Gills and others. The company proposes constructing a railroad from Union City to Tiptonville.

Chattanooga, Tenn.—It is reported that the Southern Ry. Co. (W. H. Wells, Engr. of Construction, Washington, D. C.) will shortly begin the construction of a double track between this city and Knoxville, a distance of 111 miles.

Galveston, Tex.—B. F. Yoakum, 71 Bway., New York, N. Y., Pres. St. Louis, Brownsville & Mexico R. R. and several other lines, is stated to have decided to expend $50,000,000 in new railroads in the Southwest and build about 1,000 miles of road in Texas. It is reported that he and his associates have acquired a controlling interest in the Gulf & Interstate R. R., a line from Beaumont to Bolivar, on Galveston Bay, opposite Galveston, and will develop the wharf and terminal site at Bolivar. The plans also call for the construction of a road east from the Trinity and Brazos Valley, from a point north of Houston to Beaumont, giving the 'Frisco a through line from Ft. Worth to Galveston, with lines west and east to Brownsville and Bolivar, and terminals at Bolivar and Galveston.

Amarillo, Tex.—The Gulf, Santa Fe & Northwestern Ry. Co. has been chartered to construct a line from Brownwood, northwest to a connection with the Belen cut-off of the Santa Fe Ry. at Texico, N. M., about 350 miles. The Belen cut-off, now under construction, extends from Rio Puerco on the Santa Fe Ry. east to Texico, about 269 miles, and with the line just chartered will complete the short line, and low grade, from the Gulf to the Pacific; also a branch line is chartered from Canyon City south to an intersection with the first line in Lubbock County, 125 miles. Capital, $475,000. Principal office at Amarillo, Tex. E. P. Ripley, Chicago, Ill.; J. E. Hurley, Topeka, Kan., and A. Turner, of Amarillo, are among the incorporators.

El Paso, Tex.—The Rock Island R. R. Co. (W. L. Darling, Ch. Engr., Chicago, Ill.) is reported to be considering the purchase of the Rio Grande, Sierra Madre & Pacific R. R. This road extends from El Paso to Terrazas, Mexico. If purchased it will probably be extended to the Pacific Coast of Mexico.

Paris, Tex.—It is reported that the Texas-St. Louis line of the Frisco R. R. (J. F. Hinckley, Ch. Engr., St. Louis, Mo.) is to be extended south from Paris, Tex., to Mexia, a distance of 175 miles. The preliminary survey for this proposed extension has been made.

Seymour, Tex.—It is reported that the Wichita Valley R. R. (M. C. Jones, of Seymour, Div. Supt.) is to be extended from this place for a distance of about 100 miles.

**Salt Lake City, Utah.*—It is authentically reported that the contracts for the construction of Sections 3 to 9, inclusive, of the Western Pacific R. R., which include the greater part of the mountain work, and for Section 11, have been awarded to the Utah Construction Co., of Salt Lake City.

Spokane, Wash.—The Spokane & Inland R. R. Co. is reported to have been financed and will proceed to construct a line to Colfax and Palouse.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Ensley, Ala.—Press reports state that bids are wanted until Oct. 3 for erecting a Carnegie Library at Ave. H and 18th St.; probable cost, $10,000. Breeding & Whildin, Archts, Birmingham.

Butler, Ala.—Bids will be received until Sept. 29 by the Bldg. Com. (O. L. Gray, Chmn.) at the office of the Judge of Probate, for erecting a court house.

**Ft. Wm. H. Seward, Alaska.*—J. W. Bonnell, of Tacoma, Wash., it is stated, has secured the contract to construct several buildings at Ft. Wm. H. Seward (bids received Aug. 24) at a total cost of $81,771.

Prescott, Ariz.—Bids were opened on Sept. 8 by Capt. Chas. C. Walcutt, Jr., Quartermaster, for the construction, etc., of hospital at Whipple Barracks: Thos. H. O'Neil, Denver, Col., bid for construction only $30,900; the other bids received were as follows: *a* plumbing, *b* heating: Balfe & Kroutwick, Denver, Col., *a* $2,814; Hurley & Co., St. Paul, Minn.; *a* $3,191, *b* $3,493; Johnson & Davis, Denver, Col., *a* $2,863; Newell Bros., Los Angeles, Cal., *a* $3,150, *b* $3,263; Jas. H. Mulrein, Prescott, Ariz., *a* $3,480, *b* $3,607. Chas. J. Reilly, Denver, Colo., *b* $3,693; F. E. Newbery & Co., of St. Louis, Mo., bid for electric wiring $600. Some of the bids contained deductions.

**Newport, Ark.*—E. L. Boyce, Co. Judge, writes that the contract for erecting a jail (bids opened July 29) has been awarded to Pauly Jail Co., of St. Louis, Mo., for $17,926.

San Francisco, Cal.—The Bd. Pub. Wks., it is stated, has petitioned the Bd. of Superv. for authority to construct an isolation hospital at 32d Ave. and E. St., to cost $25,000.

Colorado Springs, Colo.—Bids will be received by the Superv. Archt., Treas. Dept., Washington, D. C., until Nov. 14 for the construction of the U. S. Post-Office and Court House at Colorado Springs, as advertised in The Engineering Record.

Wilmington, Del.—Workhouse bonds amounting to $140,000, it is reported, have been sold.

Marianna, Fla.—It is stated that bids will be received until Oct. 2 for erecting a court house. Alex. Blair, Archt., Macon, Ga.

Chicago, Ill.—Andrew Sandegren, 119 Monroe St., is the architect of the new Swedish hospital which is to be built at 6010 Vincennes Ave., and to be known as the Washington Park hospital. The structure will be 3 stories high, 44x125 ft., and cost $40,000.

*The Jackson & Corbett Co., Rookery Bldg., have secured the contract for furnishing and setting in place the structural steel for the foundations of the building at 276 E. Madison St., known as the Grower Bldg., for $19,800. Bids for this work were opened on Sept. 16 by the Dept. of Pub. Wks.

**Hammond, Ind.*—Saml. Esswein, of Columbus, O., it is stated, has secured the contract for heating and plumbing the court house at a total cost of $12,977.

Peru, Ind.—W. H. Augur, County Clk., writes that nothing definite has yet been done toward erecting the proposed court house, except that the County Council has appropriated $280,000 for the work. The Comrs. are now visiting other county seats, examining court houses. No architect has been selected.

South Bend, Ind.—Bids will be received by the Bd. of Pub. Wks. (W. A. McInerney, Pres.) until Sept. 26 for the erection of 2 hose houses.

Bangor, Me.—A site has been secured on Hammond St., according to reports, on which it is proposed erecting a library.

**Baltimore, Md.*—The Bd. of Awards, it is stated, has awarded contracts for constructing the markets in Centre Market Space, bids for which were received Sept. 13, as follows: Foundation for the Produce Market to the Cranford Paving Co., Washington, D. C., at $15,990; superstructure for Produce Market to J. Henry Miller, 110 Dover St., at about $119,067 and superstructure for Fish Market to Chas. L. Stockhausen, 208 Patterson St., at about $101,900.

Bids will be received by the Bldg. Com. (John M. Carter, Chmn.) at the Actuary's office of the Maryland Inst., Richmond Market Hall, for erecting a new building for the Institute; plans and specifications may be had upon a deposit of $25, $15 of which will be refunded upon return of plans in good condition. Pell & Corbett, Archts., 31 Union Sq., New York City, N. Y.

Marlboro, Mass.—The erection of a new building for the lockup and police accommodations, it is stated, is under consideration.

**Worcester, Mass.*—Geo. C. Halcott, Supt. Pub. Bldgs., writes that E. Belisle, of Portland St., secured the contract for erecting the engine-house (bids opened Sept. 8); for $21,458. The following are reported to be the other bids received: A. N. Booth, $21,925; John S. Hubbard, $22,245; J. M. & C. J. Buckley, $24,145; Henry Mellen & Son, $24,305; Rankin & Woodside, $24,975; E. J. Cross, $23,318.98; Jas. Miles & Son, $26,250.

Ft. Warren, Mass.—Bids will be received until Sept. 29 by Maj. John E. Baxter, Q. M., U. S. A., Boston, for furnishing materials and installing steam heat in frame quarters No. 3, at this post.

**Newberry, Mich.*—John H. Foster & Sons, of Milwaukee, Wis., it is stated, have received the contract to erect a cottage at the State Hospital for the Insane at Newberry at $19,125. Other bids received for the work, it is stated, were as follows: M. J. Shirby, Sault Ste. Marie, $22,314; A. P. Wilson, Marquette, $20,200; O. G. Brubaker, Sault Ste. Marie, $20,838, and Lipsett & Sinclair, Marquette, $20,991.

Minnehaha Falls, Minn.—It is stated that bids will be received until Oct. 5 by A. F. Gauger, Archt., St. Paul, for erecting a building at the Minnesota Soldiers' Home. Cost, $75,000.

**Duluth, Minn.*—The following are the bids opened on Sept. 18 by Maj. Chas. L. Potter, Corps Engrs., U. S. A., for erecting a U. S. Engineer Building at Duluth (bidders of Duluth, unless otherwise mentioned): L. D. Campbell & Co., $17,648; Duluth Electrical & Constr. Co., $16,379 (awarded contract); Bergquist Bros., $17,865; J. F. Schleunes, $17,340; Emil M. Johnson, Minneapolis, $20,600; J. A. Robert, $16,700; Theoph. Nauffts, $18,200; John Grandy, $19,197; J. R. Quigley, $17,950; Hanson Bros., Chicago, Ill., $20,864; Geo. H. Lounsberry, $17,350; John Donlon, Superior, Wis., $17,900; W. J. Turnes Co., Chicago, Ill., $19,934; Clark Constr. Co., Chicago, Ill., $21,382; B. M. Zadeck Co., Chicago, Ill., $24,000; Congress Constr. Co., Chicago, Ill., $20,900; A. Motschman, Chicago, Ill., $17,990.

Minneapolis, Minn.—It is reported that it is proposed to erect a brick laundry and boiler room at the Ashbury M. E. Hospital, 9th St. and 9th Ave., to cost about $27,000.

**St. Louis, Mo.*—It is reported that the contract to erect the branch library at Jefferson and Lafayette Ave. has been awarded to Murch Bros., 816 Olive St., at about $40,000.

**Beatrice, Neb.*—It is reported that Johnson & Gustafson, of Irving, Kan., have secured the contract for erecting a cottage at the Inst. for Feeble Minded Youth at Beatrice, at $25,000.

Jersey City, N. J.—It is stated that $200,000 hospital bonds have been sold.

Bids will be received until Sept. 29 by the Com. on Fire Houses (Philip J. Daudt, Chmn.) for erecting Engine House No. 17 on Boyd Ave.; also same date for erecting Truck House No. 7 on Irving St.

New York, N. Y.—Bids will be received until Oct. 3 by Francis J. Lantry, Comr. of Correction, for furnishing materials and constructing new brick subway and installing new main steam and return lines and connections to the present heating systems of the various pavilions on Hart's Island.

Plans have been filed in the Dept. of Bldgs. by John J. Pallas, Comr. Parks, for the north annex to the Metropolitan Museum of Art, which is to be a 2-story and basement structure, 141 x 184 ft., to cost $1,250,000.

Bids will be received until Oct. 5 by the Park Bd. (John J. Pallas, Pres.) for furnishing materials, erecting and completing as far as specified, fire lines, sprinkler system, fire escapes and kalamein doors for the American Museum of Natural History in Manhattan Sq., Boro. Manhattan.

Tompkinsville, N. Y.—The following are the bids for furnishing material and erecting the Throggs Neck Lighthouse, Ft. Schuyler, N. Y., opened Sept. 14, by Lieut. Col. W. T. Rossell, Corps Engrs., U. S. A., at Tompkinsville: E. C. Moore, N. Y. City, $11,900, and New Jersey Fdy. & Machine Co., N. Y. City, $7,490.

Buffalo, N. Y.—Bids will be received until Oct. 3 by the Dept. Pub. Wks. (Francis G. Ward, Comr.), for erecting a brick engine house on Seneca St., to be known as No. 32; bids to be submitted separately on the following: Masonry, cut stone, iron work, plastering, etc.; carpentry, etc.; roofing, metal work, etc.; ventilating and heating, etc.; plumbing, gas fitting, etc.

Ft. H. G. Wright, N. Y.—Bids will be received by the Constr. Q. M., U. S. A., New London, Conn., until Oct. 30, for alterations to administration building and the installation of a steam heating system therein, at Ft. H. G. Wright.

Woodsfield, O.—The Co. Comrs., it is stated, have decided to erect a court house, to cost $150,000.

Cincinnati, O.—It is stated that plans will soon be prepared and the contract let for the erection of the Branch Hospital. It is reported that $225,000 bonds are to be sold for this purpose.

Enid, Okla. Ter.—It is reported that bids will be received at the office of J. F. Danelt, Co. Clk., until Oct. 10, for furnishing mateerials and erecting a court house; probable cost, $100,000. A. A. Crowell, Archt., Enid.

Philadelphia, Pa.—It is stated that bids will soon be asked by Frank Miles Day & Bro., Archts., 925 Chestnut St., for erecting a branch Carnegie Library in Vernon Park, Germantown. It is to be a 1-story and basement brick and terra cotta building.

Scranton, Pa.—M. T. Lavell, City Clk., writes that it is proposed to erect an addition to the city hall, at a cost of $50,000. Mark K. Edgar, Dir. Pub. Safety.

**Pittsburg, Pa.*—D. H. Crisman, it is stated, has secured the contract to erect the $40,000 engine house at Northumberland St., 22d Ward.

Deadwood, S. D.—It is reported that the Co. Comrs. are contemplating the erection of a court house, to cost $75,000. Bell & Detweiler, Archts., Minneapolis, Minn.

Ft. Sam Houston, Tex.—Bids will be received by L. J. Fleming, Q. M., until Oct. 18, for the construction, plumbing, heating and electric wiring of one lavatory for band, 8 single and 2 double lavatories for companies; also furnishing wire screens for doors and windows in 33 buildings, as advertised in The Engineering Record.

Sheboygan, Wis.—It is reported that bids will be received until Oct. 16 by the Bldg. Com. (C. A. Baney, Chmn.) for erecting a fire station; probable cost, $15,000.

Toronto, Ont.—It is stated that the Bd. of Control will soon ask competitive plans to be submitted by Jan. 10 for the Carnegie Library, which is to be erected at a cost not exceeding $250,000.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—Brown Bros. & Co., a real estate firm, it is stated, is interested in the project to erect a 15-story office building at First Ave. and 20th St., to cost about $500,000.

*The contract to erect a 5-story brick building for Mrs. L. P. Hudgins, it is stated, has been awarded to P. E. Bostick, at $43,000.

Atlanta, Ga.—It is stated that the Louisville & Nashville R. R. Co. (W. H. Courtenay, Ch. Engr., Louisville, Ky.) intends erecting a passenger station in the vicinity of Waverly Pl.

College Park, Ga.—The citizens are said to be contemplating the erection of a clubhouse 3 stories high, to cost $50,000.

Chicago, Ill.—D. H. Burnham & Co., Ry. Exch. Bldg., are preparing plans for a mercantile building at 145 State St., to be erected by Otto Young. The structure will be 12 stories high, with foundations strong enough to carry 6 additional stories, and will cost $825,000.

Holabird & Roche, 1618 Monadnock Bldg., are preparing plans for an 11-story addition to the Auditorium Annex at 228 Michigan Boule. Cost about $300,000.

The Crown Hill Cemetery Assoc. has been incorporated

**Items marked thus give the names of parties awarded contracts.*

with a capital stock of $125,000 and Clayton E. Bordman, Chas. W. Horn and others as incorporators. The company has acquired a tract of 80 acres near the county limits where the Illinois Central, the Maple Leaf and the Elgin & Aurora Railroads meet, and will improve the tract for use next spring. An iron fence is to inclose the entire tract, an ornamental gate and lodge is to be built at once, and next spring a concrete vault, stone chapel and greenhouse are to be added. These improvements will cost about $100,000.

Frost & Granger, 184 La Salle St., are preparing plans for a new passenger station which the Chicago & Western Indiana R. R. will erect at its 47th St. crossing. The building will be 2 stories high, of pressed brick and stone, and cost $25,000.

A building permit, it is stated, has been granted to the Northwestern Elevated R. R. (E. C. Moe, Gen. Supt., 1117 Merchant's Loan & Trust Bldg.) for the erection of a station to cost $20,000.

French Lick, Ind.—A. H. Brown, it is stated, has ordered plans prepared for a hotel to be erected here at a cost of $200,000.

Terra Haute, Ind.—The United Odd Fellows Lodges, it is stated, have appointed a committee to make arrangements for the erection of a 5-story building for lodge purposes, to cost about $100,000.

Sioux City, Ia.—Sanguinet & Staats, of Ft. Worth, Tex., it is reported, have been engaged by the officials of the First National Bank and Farmers' Loan & Trust Co., to prepare plans for a 10-story steel and brick bank and office building, to be erected at 4th and Nebraska Sts.

**Baltimore, Md.*—E. D. Preston, 22 Builders' Exchange Bldg., it is stated, has secured the contract to erect a 5-story brick building for Mrs. McCreary, at a cost of $32,000.

J. F. Gerwig, it is reported, has prepared plans for a 5-story warehouse, to be erected for Mrs. Mary Mylander, at a cost of $45,000.

**Haverhill, Mass.*—Keely Bros., 6 Park St., it is stated, have secured the contract to erect a factory on Walnut St. at $47,600.

Calumet, Mich.—It is stated that the manual training building of the Calumet High School and the Miscowaubik Club House has been destroyed by fire.

**St. Paul, Minn.*—Butler Bros., N. Y. Life Bldg., are stated to have secured the contract for erecting a 3-story brick and iron building for stores and offices on 6th, Wabasha and Cedar Sts., for Wm. and Henry Endicott, to cost about $100,000.

*Thos. Fitzpatrick & Son, 17 W. 9th St., have secured the contract for erecting a brick building on Cedar and 6th Sts., for Wm. and Henry Endicott, at $38,000.

Minneapolis, Minn.—Nicolet Lodge, No. 16 A. O. U. W., will erect a 3-story brick store and lodge building at 308 Central Ave., at a cost of $20,000.

It is stated that the Winkley Artifical Limb Co. is to erect a 2-story concrete office and factory building at 1328 Washington Ave. N., to cost about $20,000.

Meridian, Miss.—It is stated that a Y. M. C. A. bldg. is to be erected here. Probable cost, $100,000. E. B. Williams may be able to give further information.

Neosho, Mo.—It is stated that bids will be received until Sept. 26 for erecting 3 brick buildings for a bank and 2 business houses. A. C. Michaelis, Archt., Joplin.

Kansas City, Mo.—The Order of Elks, it is reported, has accepted the plans of Wm. H. Sayler, Commerce Bldg., for an addition to their clubhouse, which is to cost about $40,000.

**St. Louis, Mo.*—The Southern Illinois Constr. Co., of East St. Louis, Ill., it is stated, has secured the contract to erect a 6-story buff brick building for the C. F. Niedringhaus Real Estate Co., to cost $30,000.

Omaha, Neb.—The Cudahy Packing Co., it is reported, has secured a permit to erect a warehouse, to cost $20,000.

*J. D. Schellberg, it is stated, has secured the contract to erect a 3-story brick warehouse for C. Dreibus, to cost $30,000.

Albany, N. Y.—The John G. Myers Co., it is stated, is making preparations to erect a new building on the site of the building which collapsed recently.

Goldsboro, N. C.—The Bldg. Com. of Neuse Lodge No. 6, I. O. O. F., it is stated, on Sept. 12, accepted the plans of Henry Bonitz, of Wilmington, for the 3-story brick, terra cotta and limestone building, 56x100 ft., which it is proposed erecting on John St., at a cost of $20,000.

Lorain, O.—It is stated that Fleming & Miler intend erecting a $25,000 office building.

Flushing, O.—The business men, it is reported, are about to organize the Peoples Home Supply Co., with a capital of $50,000, for the purpose of erecting a department store on the Bethel Hotel site, the cost of the building to be about $20,000. J. C. Adair and A. M. Brown are reported interested.

Elyria, O.—H. H. Smith, it is stated, has ordered plans prepared for a 2-story building, 250x35 ft., to be erected as an addition to his furniture store on Broad and 2nd Sts.

Cincinnati, O.—The Cincinnati Traction Co. (Thos. Elliott, Ch. Engr., 5th and Walnut Sts.), it is stated, intends erecting a car barn on Riddle St., to cost about $25,000.

**Wauseon, O.*—The contract to erect the Arcade Bldg., it is stated, has been awarded to Phender Bros., of Toledo, at $20,000.

Cleveland, O.—Geo. B. Post, of New York, N. Y., it is stated, has completed plans for the Cleveland Trust Co.'s building, which is to be erected on Erie and Euclid Aves., and it is reported that bids for the construction are now being received. Estimated cost, $500,000.

John Eisenmann, The Arcade, it is stated, has prepared plans for a 6-story, 60x113 ft. brick and stone building, which is to be erected on Euclid Ave., for the Fireproof Storage Co., at a cost of $100,000.

Dayton, O.—Detailed plans have been prepared, according to reports, for a 6-story Y. M. C. A. building. H. A. Wilbur, Gen. Secy.

**Youngstown, O.*—Fredk. Holleck, it is stated, has secured the contract to erect a brick building for the Wilkers Leonard Hardware Co. Cost, $18,000.

Mt. Vernon, O.—Messrs. Ickes and Stergon, it is stated, are interested in a project to erect a theatre here at a cost of $25,000.

**Philadelphia, Pa.*—The contract to make alterations to the Hotel Edouard, at 13th and Walnut Sts., it is stated, has been awarded to John R. Higgins & Co., Heed Bldg., at $60,000.

Wm. R. Fogg, it is stated, has been granted a permit to erect a 5-story warehouse, 43x125 ft., at 2d St. and Montgomery Ave., for Wm. Montgomery & Co., to cost $40,000. Ballinger & Perrot, 102 S. 12th St., Archts.

*Doyle & Doak, 1509 Sansom St., it is stated, have been granted a permit to erect a 2-story granite, 20x104 ft. bank building for the Tradesmen's Trust Co., at Juniper and Chestnut Sts., to cost $75,000.

**Pittsburg, Pa.*—Kerr & Fox, 2565 5th Ave., it is reported, have secured the contract to erect a 4-story theatre building for the Pittsburg Opera House Co., at a cost of $125,000.

Knoxville, Tenn.—A permit has been granted to Dr. C. Deaderick to erect a 7-story and basement addition to the Empire Bldg., estimated to cost $25,000. Thomas & Turner, builders; Bauman Bros., 612½ Gay St., Archts.

Bristol, Tenn.—The freight depot here, owned jointly by the Norfolk & Western and the Southern Ry., it is reported, was destroyed by fire Sept. 14. D. W. Lum, Ch. Engr. M. of W. and Structures, of Southern Ry., Washington, D. C.

Lufkin, Tex.—McCarthy, Starnes & Co., of Lufkin, consulting engrs., are preparing plans and specifications for a 175-room sanitarium to be constructed of reinforced concrete steel, fireproof through, strictly modern in all appointments. The requirements will be fan system of ventilation, electric lighting and heating plant, refrigerating plant, electric elevator, electric annunciators, speaking tubes, telephone system, Turkish and sanitary bathing apparatus, toilet equipment, laundry, laboratory and surgical equipment, marble floor and walls, solid glass floor and wall lining for surgical and operating compartments. Catalogues and quotations are desired for all structural material and equipment neccesary.

**Spokane, Wash.*—M. C. Murphy, it is stated, has secured the contract to erect a theatre on Howard St., 75x100 ft., to cost $34,400. Preusse & Zittel, Jameson Bldg., are the archts.

*P. L. Peterson, 2220 Ridge Ave., it is stated, has secured the contract to erect the terminal station for the Spokane & Inland Electric Ry. Co., at Lincoln and Main Aves., at $95,000.

**Aberdeen, Wash.*—M. Rightsman, it is reported, has the contract for erecting a stone block for Wack, Hulburt & Lewis, at $15,247.

**Seattle, Wash.*—Plans have been filed, according to reports, for a 3-story brick business building which is to be erected at 1923 First Ave. for Geo. A. Smith, at a cost of $17,000. W. P. White, Archt., Washington Bldg.; C. W. Bamberg, contractor.

It is stated that a Y. M. C. A. building, estimated to cost, including site, $185,000, is to be erected at 4th and Madison Sts.

Milwaukee, Wis.—It is stated that E. A. Bouer has had plans prepared for a paper warehouse, 100x150 ft., which is to be erected at Hanover and Oregon Sts., at a cost of $25,000.

Ottawa, Ont.—Plans have been prepared, according to reports, for a hotel to be erected here by the Grand Trunk Pacific Ry. (J. Hobson, Ch. Engr., Montreal, Que.). It is understood that the hotel will be constructed on the site of the present Central Station and will be a depot and hotel combined.

NEW YORK. N. Y.

78 South St., 5-story br. and Stone warehouse; c. $39,000; o, J. N. A. Griswold; a, F. H. Bosworth.

229 West St., 6-story br. and stone warehouse; c, $50,000; o, The James Reilly Repair & Supply Co.; a, Henry I. Cobb.

406 W. 45th St., 6-story br. and stone stable; c, $30,000; o, Thorndale Farms Dairy Co.; c, Frank A. Rooke.

303 E. 62d St., 5-story br. and stone storage bldg.; c, $50,000; o, Fred J. Schillinger; a, Hugo H. Avolin.

Lerington Ave. and 101st St., 6-story br. and stone store and tenement; c, $45,000; o, Lazar Wallenstein; a, Horenburger & Straub.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Denver, Colo.—It is reported that a R. C. Cathedral is to be erected here at a cost of $250,000. Address Bishop N. C. Matz.

Jacksonville, Fla.—Bids are wanted for erecting the R. C. Church of the Immaculate Conception; address, M. H. Hubbard, Archt., Windsor Hotel.

Chicago, Ill.—Niels Buck, 125 La Salle St., has secured a site on Centre St. and Seminary Ave. and intends erecting an apartment building, three stories high, to cost $180,000.

John Duncan, the builder, contemplates the construction of a 3-story apartment building on Humboldt Boule., 325x125, to cost $180,000.

Henry L. Newhouse, 4530 Prairie Ave., has prepared plans for 5 apartment buildings to be built at Forrestville Ave. and 48th St. for Simeon Lederer. These buildings will be 3 stories high and will cost $150,000.

George and Fred McLaughlin have purchased a tract of 27 acres on the Green Bay road and Laurel Ave., and contemplate the erection of two summer homes, which will probably cost a total of $100,000.

Benjamin H. Marshall, 28 Jackson Boule., it is stated, has secured a site at Lake Shore drive and Cedar St., on which it is proposed erecting an apartment house, to cost $250,000.

The congregation of the R. C. Church of the Providence of God will soon begin the erection of a new church at 166 W. 18th St., after plans by J. S. Flizkowski, 1059 N. 4th St. The building will be of pressed brick and stone, 80x150 ft., with two towers, each 220 ft. high. Cost, $80,000.

Preliminary sketches have been made for an ornamental apartment building, costing $300,000, that is to be built by Caleb H. Marshall and others on the Lake Shore drive near Schiller St.

Taunton, Mass.—Fontaine & Connicut, of Woonsocket, R. I., are reported to be completing plans for a R. C. church, to be erected at Taunton, to cost about $60,000. Rev. A. Carrier, Pastor.

*The Granite Constr. Co., of Fall River, is reported to have secured the contract for building the rectory for the above edifice, for $12,000.

**Duluth, Minn.*—F. L. Johnson, 115 E. 7th St., it is stated, has received the contract to erect the First Swedish Lutheran Church, at $17,500.

*Edw. Jackson, Manhattan Bldg., it is stated, has secured the contract to erect the St. Mary's R. C. Church, at $30,000.

Minneapolis, Minn.—T. F. Curtis will erect a 4-story apartment house at 311 S. 10th St., to cost $38,000.

Beatrice, Neb.—The members of the St. Joseph R. C. Church, it is stated, are contemplating the erection of a new edifice to cost $25,000.

Lincoln, Neb.—The congregation of the Plymouth Church, it is stated, is contemplating the erection of a new edifice at a cost of $30,000. Rev. H. Rogers, pastor.

Hoboken, N. J.—Eugene Ciccarelli, 2d Natl. Bank Bldg., it is stated, has prepared plans for a 4-story brick flat, to be erected at Monroe and 5th Sts., at a cost of $15,000.

New York, N. Y.—Plans have been filed for 3 model tenement houses which are to be erected at 321-37 E. 35th St., with the Henry Phipps' appropriation. The estimated cost of these 3 buildings is $225,000.

Rochester, N. Y.—S. Cornwall, it is reported, has applied for a permit to erect a 3-story brick and stone apartment house on Elm St., to cost $25,000.

Walhalla, N. D.—Jos. Bell De Remer, of Grand Forks, it is stated, has been engaged to prepare plans and superintend the construction of an edifice for the Walhalla R. C. Church, to cost in the neighborhood of $18,000.

Barberton, O.—The members of the First Presbyterian Church, it is stated, are planning to erect a new edifice estimated to cost $20,000. Rev. Sharpe, Pastor.

**Columbus, O.*—The contract for the new church of the Holy Rosary, it is stated, has been let to D. W. McGrath, Ruggery Bldg., and J. W. Sweeny, at a total cost of $20,000.

**Cleveland, O.*—J. Milton Dyer, Archt., Cuyahoga Bldg., it is stated, has awarded the general contract for a residence for J. M. Ricand to the W. B. McAllister Co., 20 Newton St. It is reported that the residence is estimated to cost $250,000.

Youngstown, O.—An edifice, it is stated, is to be erected at De Lason and Oakhill Aves. for the Epworth M. E. Church, to cost $25,000.

**Canton, O.*—John L. Van Kirk, of Canton, has secured the contract for erecting an edifice for the First United Evangelical Church, on E. 3d and Church Sts.; cost, $20,000. Architect, M. E. Harpster, of Akron.

**Oklahoma, Okla. Ter.*—The contract to erect the First Baptist Church, it is reported, has been awarded to J. W. Lucas, at $75,000.

**Merion, Pa.*—The contract to erect a chapel in Lower Merion for the St. John Episcopal Church, it is stated, has been awarded to Appleton & Burrell, of Philadelphia, at $17,000.

**Homestead, Pa.*—Geo. M. Hall & Co., of Homestead, it is reported, have secured the contract to erect a school and parochial residence for St. Michaels Slavish Church, at a cost of $40,000.

**Aiken, S. C.*—W. H. Hite, it is reported, has secured the contract for an edifice for the R. C. Church, to cost $20,000. Macmurphy & Story, Archts, Augusta, Ga.

Bellingham, Wash.—It is reported that an edifice is to be erected for St. Paul Episcopal Church at a cost of $20,000. Rev. A. W. Cheatham, pastor.

**Spokane, Wash.*—Mrs. W. J. Harris, it is stated, has awarded the contract to erect an apartment house at Pacific Ave. and Spruce St., to J. E. Cunningham, at $63,000.

Spokane, Wash.—Cutter & Malmgren, Exchange Bldg., it is stated, have completed plans for a 2-story residence, to be erected at Boulevard and Boone Aves., for Dr. C. P. Thomas, at a cost of $25,000.

A permit has been granted to Inkster Bros., to erect a 3-story brick apartment house on Riverside Ave., to cost approximately $15,000.

NEW YORK, N. Y.

365 Madison St., 6-story br. and stone tenemt.; c, $40,000; o, Hauben Realty Co.; a, Bernstein & Bernstein.

81st St. and East End Ave., 6-story br. and stone tenemts.; c, $50,000; o, Chas. R. Fleischmann; a, Adolph Mertin.

133d St. and Amsterdam Ave., 6-story br. and stone tenemt.; c, $50,000; o, Simon Marcus; a, B. W. Levitan.

146th St. and Convent Ave., 5-story br. and stone tenemt.; c, $26,000; o, David Karp and Morriss Heller; a, John Hauser.

148th St. and Bway, 2 5-story br. and stone tenemts.; total c, $100,000; o, Peck & Goldstein; a, B. W. Levitan.

151st St. and Convent Ave., 2 5-story br. and stone tenemts.; total c, $120,000; o, McKinley Realty & Constr. Co.; a, John Hauser.

Audubon Ave. and 173d St., 6-story br. and stone tenemt.; c, $140,000; o, Frank T. Kee; a, Henry Fouchaux.

Convent Ave. and 152d St., 5-story br. and stone tenemt.; c, $85,0000; o, McKinley Realty & Constr. Co.; a, John Hauser.

St. Nicholas Ave. and 150th St., 4 5-story br. and stone tenemts.; total c, $180,000; o, Kantor, Cooper & Co.; a, Schwartz & Gross.

Simpson St. and Westchester Ave., 10 5-story br. tenemts.; total c, $400,000; o, American Real Estate Co.; a, Wm. D. Johnson.

SCHOOLS.

Notes Arranged Alphabetically by States.

**Oakland, Cal.*—Contracts have been awarded, according to reports, for work on Lincoln school, as follows: structural steel, to Clinton Bridge & Iron Wks., Clinton, Ia., at $16,570; carpenter work, to Ransome-Griffith Co., at $26,542; fireproofing, to Long & Hoyt, at $12,598; galvanized iron and roofing, to Forderer Cornice Wks., San Francisco, $7,257, and marble and tile works, to Vermont Marble Co., Proctor, Vt., at $4,057. M. Brendt secured the contract for the brick work, terra cotta, stone and granite work.

San Pedro, Cal.—Archt. F. S. Allen, of Pasadena, writes that bids will be received until Oct. 20 for the erection of a high school at San Pedro, to cost about $50,000.

Key West, Fla.—The citizens have voted in favor of issuing $60,000 bonds to build and repair the county schools. Sears school, it is stated, is to be replaced with a stone or concrete structure.

Tallahassie, Fla.—It is reported that arrangements are being made to erect a $25,000 building at Leon Academy. Geo. B. Perkins is a member of the School Trus.

Newnan, Ga.—The citizens, it is stated, have voted in favor of issuing bonds to erect a school.

Englewood, Ill.—The Englewood high school is to be enlarged by the construction of a 3-story addition to the present structure at Stewart Ave. and 62d St. Cost, $150,000.

Items marked thus give the names of parties awarded contracts.

Oak Park, Ill.—It is reported that Robt. C. Spencer, Jr., 17 Van Buren St., Chicago, has completed plans for a 3-story high school to be erected in Oak Park, at a cost of $160,000.

Pauls Valley, Ind. Ter.—It is stated that bonds are soon to be issued amounting to $25,000 for the erection of a brick school.

Lindsay, Ind. Ter.—School bonds, amounting to $10,000, it is stated, are soon to be issued for the erection of a brick school.

Topeka, Kan.—The Kansas Medical College, it is stated, intends erecting a college building to cost about $45,000. Dr. W. S. Lindsay is a member of the Bd.

Hagerstown, Md.—It is stated that plans are being prepared for a high school to cost about $50,000. Address, the School Comrs.

**Crystal Falls, Mich.*—The contract to erect the high school, it is stated, has been awarded to the General Constr. Co., of Milwaukee, Wis., at $34,660. The contract for the heating and plumbing of same, it is reported, has been awarded to the Lake Superior Htg. Co., of Ishpeming, at $8,967.

Calumet, Mich.—See "Business Buildings."

Detroit, Mich.—It is stated that the following are the lowest bidders on some of the work in connection with the erection of Montieth school (bids for which were received Sept. 12). Total cost $52,115; Carpenter work, John Whitaker & Co., $13,900; mason work, F. H. Goddard, $13,983; iron work, Whitehead & Kales Iron Wks., $1,944; cut stone, R. Robertson & Co., $3,481; slate and metal work, Adam J. Orth, $1,950; plumbing, Jas. W. Partlan, $2,318; heating and ventilating, Jacob Zerga, $7,044; heat regulation, The Powers Regulator Co., $1,020; electric wiring, Britten & Haines Electric Co., $488.

Bids will be received until Sept. 26 by the Bd. Educ. (Wm. J. Lee, Secy.) for furnishing materials and erecting a 15-room school building, to be known as the Zachariah Chandler School.

**Peru, Neb.*—The following are reported to be the bids received recently for erecting a library at the State Normal School at Peru: Marsen & Rokahi, of Avoca, Ia., $26,860; Jos. H. Sparks, of St. Joseph, Mo., $24,800; W. L. Campbell, of Lincoln, $23,760; L. C. Dibbro, of Lincoln, $22,800, and Shaul & Assenmacker, Seneca, Kan., $20,222 (awarded contract).

*The contract for plumbing in said building, it is reported, has been awarded to F. C. Phillips, of Lincoln, at $7,300.

F. C. Phillips, of Lincoln, it is stated, submitted the lowest bid for the electric wiring of said building at $1,200.

Newark, N. J.—School bonds amounting to $250,000, it is stated, have been sold.

Convent Station, N. J.—Bids will be received about Sept. 25 for erecting a dormitory at Convent Station for St. Elizabeth College. Architect, Eugene A. McMurray, 22 Clinton St., Newark.

Paterson, N. J.—It is stated that the erection of a high school at a cost of about $350,000 is under consideration.

New York, N. Y.—Bids will be received by C. B. J. Snyder, Supt. School Bldgs., until Oct. 2, for general construction, etc., of additions to and alterations in School 25; also School 158, all in Boro. Manhattan.

Hempstead, L. I., N. Y.—The Bd. of Educ., it is stated, has accepted the plans of Scofield & Allen, of Hempstead, for the 2-story and basement brick school, to be erected on Prospect St.; estimated cost $53,400.

Cooperstown, N. Y.—It is stated that a school is to be erected here at a cost of $100,000.

Marietta, O.—It is stated that bids will be received until Oct. 5 by President of Marietta College for tearing down the present dormitory and erecting a new dormitory and new library. Patton & Miller, Archts., 140 Dearborn St., Chicago, Ill.

Cleveland, O.—It is stated that the erection of a $150,000 high school in the East-South Dist. is under consideration.

**Wellston, O.*—The following are reported to be the bids received Sept. 11 for erecting the South school: A. B. Leach & Sons, Wellston, $21,216 (awarded contract); W. B. Drake, $21,857, and Jos. Gooding, $21,304.

**Oklahoma, Okla. Ter.*—J. W. Lucas, it is stated, has secured the contract to erect the Franklin School at $17,880. The contract for the heating of same, it is stated, has been awarded to Lewis & Kitchen, of Kansas City, Mo., at $5,410.

Homestead, Pa.—See "Churches and Dwellings."

Philadelphia, Pa.—It is stated that the plans which Cope & Stewardson, 320 Walnut St., will prepare for the buildings for the Veterinary Dept. of the Univ. of Pennsylvania, will provide for several 2 and 3-story fireproof structures, embracing an area about 250x200 ft. It is reported that about $250,000 will be spent on the building and equipment.

Lancaster, Pa.—It is stated that the Comn. appointed by Gov. Pennypacker to superintend the erection of the Stevens Industrial School has decided to consolidate the money available—$50,000 by Legislature, $78,000 by Thaddeus Stevens will and $10,000 by school interests of the State—and to at once proceed with the erection of the school buildings.

Amarillo, Tex.—Bids will be received until Sept. 28 by the Bd. Educ. (R. L. Stringfellow, Pres.) for erecting a 2-story brick school; separate bids will be received for plumbing and heating. C. H. Page, Jr., Archt., Austin.

**Fairmont, W. Va.*—Holbert & Spedden, of Fairmont, it is stated, have secured the contract to erect a girls' dormitory at the Fairmont Normal School, at $14,000.

**Guelph, Ont.*—S. F. Whitman, of Brantford, it is stated, has secured the contract to erect an implement hall and 2 cottages at the Ontario Agricultural College at Guelph, at a total cost of $30,110.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Moline, Ill.—The City Council has decided to accept the proposition of C. W. Smith, of Davenport, Ia., who proposes constructing a garbage crematory with a retort system of a capacity of about 30 tons per day, to cost about $25,000.

Davenport, Ia.—Ed. Collins, City Clk., writes in regard to the construction of a garbage crematory, that nothing definite has yet been done. E. B. Wright has made a proposition to put in a cell system plant, and that is now being discussed.

Brooklyn, N. Y.—Bids will be received by John McG. Woodbury, Com. Street Cleaning, New York City, until Oct. 3, for furnishing materials and removing snow and ice by April 15, 1906, Boro. Brooklyn.

Philadelphia, Pa.—The following are reported to be the lowest bids on each district opened on Sept. 18 by A. Lincoln Acker, Dir. Dept. Pub. Wks., for cleaning the streets during 1906: 1st Dist., H. A. Cleman, $80,000; 2d Dist., E. H. Vare, $49,999; 3d Dist., E. H. Vare, $89,999; 4th Dist., Thos. Parker, $82,000; 5th Dist., Howard E. Ruch, $102,000; 6th and 7th Dists., Jas. Curran, ea. $75,000; 8th Dist., E. H. Vare, $128,998; 9th Dist., David McMahon, $74,485; 10th Dist., David Peoples, $60,000, and 11th Dist., Jas. Irvin, $49,888.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

The Grand Rapids (Mich.) Foundry Co. is adding to its present foundry a 1-story building, 100x100 ft. A traveling crane and other modern appliances will be installed.

Peoples' Economy Ice Co., Petersburg, Va., recently incorporated, will shortly install an ice making plant.

The Clark Lumber & Fixture Co., Barberton, O., is erecting a modern plant at Ft. Wayne, Ind. The main building will measure 60x260 ft., 2 stories. This company is in the market for a large number of wood working machines, to be operated by individual motors, and engine, boiler and generator.

J. H. Sessions & Son, Bristol, Conn., will build a new plant, consisting of six or seven buildings. Power plant of 175 to 200 hp. will be required.

Michigan Wire Fence Co., Adrian, Mich., is erecting a new 2-story factory, 50x155 ft. This company is in the market for fence working machinery, together with electrical equipment for operating same.

Jackson (Tenn.) Woolen Mills will rebuild their plant recently destroyed by fire. New building will be 4-story brick, 60x160 ft.

Business Men's Association, Louisiana, Mo., will erect for a Chicago shoe firm a factory building of standard mill construction, 45x120 ft. The new building will be 3 stories high, equipped with 40-hp. engine, 80-hp. boiler, heating plant, sprinkling system and freight elevator. Inquiries should be sent to P. P. Smith, Secretary.

Syracuse (N. Y.) Safe Co. is preparing plans for a new plant.

American Machine Co., Louisville, Ky., is erecting a new foundry and is in the market for complete foundry equipment.

The Kiechler Mfg. Co., Cincinnati, O., sheet metal mfrs., are preparing plans for a new plant.

Electrical Construction Co., Columbus, O., will install a new plant at the Jefferson County Infirmary, Steubenville, O., to consist of the following: 65 to 80-hp. engine direct-connected to a 50-kw. generator, together with switchboard and necessary wiring.

Hercules Gas Engine Works, San Francisco, Cal., whose plant was recently destroyed by fire, has secured new site and is now engaged in rebuilding. This company is in the market for a full equipment of the latest improved machine shop tools, including planers, shapers, milling machines, lathes, rotary and standard drills, gear cutters and special tools. Overhead traveling cranes will be installed. Company wishes catalogues and quotations.

Havana (Ill.) Mfg. Co. will erect an addition to its present plant, consisting of office building, fireproof oil and pattern storage. Old plant will undergo general rearrangement.

Starke (Fla.) Ice Co., J. R. Davis, Secy., is in the market for a 10-ton ice making plant.

Henry Hollinger, Columbia, Pa., will shortly rebuild his tanning plant, recently destroyed by fire.

O. C. Rohrbach, Topton, Pa., will build a new underwear knitting plant. The new building will be constructed of brick and will measure 26x50 ft.; capacity, 100 doz. per day.

W. S. Dickey Clay Mfg. Co., Kansas City, Mo., is planning to rebuild its plant which was recently burned.

Atlantic Coast Lumber Corporation, Georgetown, S. C., is preparing plans for a new plant to replace plant recently burned.

San Telmo Cigar Mfg. Co., Detroit, Mich., is having plans prepared for a 110x180 ft. factory building, to be 3 stories high and of standard mill construction, according to local newspaper reports.

Wm. Hahn and Christopher Leschhorn, of Rochester, will establish a brass foundry in Binghamton, N. Y., according to local newspaper reports.

American Sheet & Tin Plate Co., Morgantown, W. Va., will make extensive additions to its present plant, according to local reports.

W. J. Oliver, Knoxville, Tenn., will build a large foundry, to cost about $150,000, according to local newspaper reports.

A. H. Ivins, formerly General Manager of the Traders' Division of the United Box Board Co., is at the head of a company that will erect a large paper mill at Bogota, N. J.

Samuel Carlson and Abraham Barger, Northampton, Mass., have purchased mill property at Loudville and will install plant for the manufacture of leather board.

Niles-Bement-Pond Co. is planning to erect an addition to the works of the John Bertram & Sons Co., Dundas, Ont. The addition will consist of a foundry building, 200x120 ft., of steel construction.

The Marion (O.) Steam Shovel Co. is erecting additions to its plant, consisting of boiler shop, 80x210 ft., and new carpenter shop of the same dimensions.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Sacramento, Cal.—The City Trus. will expend about $80,000 on the levee system this winter, which is being contracted for in sections.

Washington, D. C.—Bids will be received until Oct. 21 by Lieut. Col. R. L. Hoxie, Corps. Engrs., U. S. A., Washington, for dredging in Breton Bay, Md., Occoquan and Carters Creeks, and Mattaponi and Pamunkey Rivers, Va., as advertised in The Engineering Record.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Indianapolis, Ind.—Bids will be received until Sept. 29 by the Dept. Pub. Wks. (M. A. Downing, Pres.) for constructing a concrete retaining wall on a portion of the north side of Fall Creek.

Marshalltown, Ia.—Bids will be received until Oct. 10 by the Co. Bd. Superv., for constructing 4¾ miles of ditch and main in Drainage Dist. No. 2, requiring 3,600 cu. yds. excav.; W. E. McLeland, Co. Aud.

Pocahontas, Ia.—Bids will be received by G. W. Smeltzer, County Aud., for work and tile on Drainage Dist. Nos. 11, 12 and 15, to consist of about 30,300 ft. of tile, from 8 to 16-in., and 4,300 cu. yds. open work, as advertised The Engineering Record.

Sioux City, Ia.—Maj. H. M. Chittenden, of Sioux City, is reported to have prepared and submitted to the Dept. of U. S. Engrs. a detail report on the work in Yellowstone National Park, in which he estimates the cost of improving the park for the next 20 years at $2,000,000. About $150,000 will be expended this season.

Boston, Mass.—Bids will be received until Oct. 7 by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, for a pile and timber pier, at the Navy Yard, Boston.

Bids will be received until Oct. 17 at the Bureau Supplies and Accounts, Navy Dept., Washington, to furnish at the Navy Yard, Boston, one 10-ton locomotive crane. H. T. B. Harris, Paymaster-Gen., U. S. N.

Minneapolis, Minn.—It is proposed to install in the court house and city hall 2 passenger elevotors, at a cost of $15,000.

The Minneapolis Dry Goods Co. proposes installing two electric elevators at 501-507 Nicollet Ave., at a cost of $10,000.

Glendive, Mont.—F. E. Weymouth, of Glendive, Project Engr., U. S. Reclamation Service, writes that no bids were received on Aug. 21 for furnishing 600,000 lbs. of square steel bars for reinforcement of concrete.

Paterson, N. J.—Abbott & Tyler, of Rutherford, are reported to have submitted to the Street Com. of the Bd. of Aldermen, a report on the dredging of Passaic River and safeguarding property from floods. They estimate the cost of dredging and providing retaining walls on each side of the river at $265,300.

New York, N. Y.—Bids will be received by Col. W. R. Livermore, Corps Engrs., U. S. A., Army Bldg., N. Y. City, until Oct. 3, for dredging in Raritan Bay, Keyport Harbor, Matteawan Creek, Elizabeth River and School Harbor and Compton Creek, N. J., as advertised in The Engineering Record.

The following are the bids opened on Sept. 14 by Col. W. P. Livermore, Corps Engrs., U. S. A., for dredging: *a* Mamaroneck Harbor, 6,667 cu. yds.; *b* Port Chester Harbor, 12,000 cu. yds.; *c* East Chester Creek, 7,143 cu. yds. Seely-Taylor Co., 78 Broad St., N. Y. City, *a* 38 cts., *b* 41 cts., *c* 35 cts.; John & Jos. McSpirit, 118 Wayne St., Jersey City, N. J., *a* 27 cts., *b* 25 cts., *c* 42 cts. No bids were received for dredging Great South Bay.

The following are the bids opened on Sept. 16 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for furnishing a 15-ton auxiliary hoist at the Navy Yard, New York: R. G. Packard Co., 130 Pearl St., N. Y. City, $15,519; the Brown Hoisting Machinery Co., Cleveland, O., $18,762.

Bids will be received until Sept. 29 by Maurice Featherson, Comr. Docks and Ferries, for furnishing material and building a new pier, with appurtenances, at the foot of E. 120th St., Boro. Manhattan.

New York, N. Y.—Bids will be received until Sept. 25 by Maj. G. S. Bingham, Q. M., U. S. A., Army Bldg., Whitehall St., for furnishing and delivering at said building, one 40-h.p. boiler.

Bids will be received until Sept. 26 by Louis F. Haffen, Pres. Boro. Bronx, for furnishing and delivering engineering supplies.

New York, N. Y.—See "Paving and Roadmaking."

Troy, N. Y.—Bids will be received until Sept. 26 by the Bd. Contract and Supply (Jas. M. Riley, Clk.) for excavating and removing about 1,200 cu. yds. of material from canal approach to the tunnel.

Geneva, N. Y.—The Bd. of Pub. Wks. is reported to be considering the construction of a conduit system.

Dresden, O.—Bids will be received until Oct. 10 by the State Bd. Pub. Wks. (Chas. E. Perkins, Ch. Engr.) at Columbus, for improving the outlet lock at the Northern Div. of the Ohio and Erie Canal, at Dresden.

Akron, O.—Bids will be received by the State Bd. of Pub. Wks. (W. H. McClintock, Clk.) at Columbus until Oct. 3 (readvertisement) for deepening and widening Ohio Canal from Cleveland, south about 30 miles. Blank forms and further information may be had on application to F. D. Paul, C. E. Lock No. 1, Akron, O. Chas. E. Perkins, Ch. Engr., Columbus.

**Dayton, O.*—Geo. R. Hively, of Dayton, has secured the contract for constructing the Riverside dam (bids opened by the Bd. of Pub. Service, Sept. 12) at $6,204 without piers and abutments: The other bids received were (*a*) without piers and abutments, (*b*) including piers and abutments: Paul & Kershner *a* $6,600, *b* $7,800; Chris. Poock, *a* $8,160, *b* $10,270; Gabler & Deeter, *a* $11,000, *b* $11,700; David A.Onkst, *b* $11,960.

*W. H. Koch, Asst. Clk. Bd. Pub. Service, writes that the contract for constructing a concrete dam over Great Miami River in Riverdale (bids opened Sept. 12)) has been awarded to Geo. R. Hively, of Dayton, for $6,204.

The State Bd. of Pub. Wks. is reported to have authorized Chas. E. Perkins, Chief Engr., Columbus, to prepare plans for an aqueduct, to be erected 5 miles north of Dayton, to cost about $10,000.

Panama.—Bids will be received by the Isthmian Canal Comn., Washington, D. C. (D. W. Ross, Purchasing Agent) until Sept. 30 for furnishing well drills and appurtenances, magnesia boiler lagging, etc.

Bids will be received until Oct. 4 by the Isthmian Canal Comn., Washington, D. C. (D. W. Ross, Gen. Purchasing Agt.) for furnishing 800 wooden or steel flat cars, 19 70-ton steam shovels, six 60-ton extra heavy rapid unloaders and 12 unloading plows.

Reading, Pa.—Bids will be received until Sept. 28 by the Bd. Pub. Wks. for constructing a subway under the P. & R. Ry. tracks at Spring St. Elmer H. Beard, City Engr.

San Juan, Porto Rico.—Bids will be received until Oct. 17 at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., to furnish at the Naval Station, San Juan, a quantity of brick, sand, Portland cement, etc.

Pawtucket, R. I.—The following are the bids opened on Sept. 20 by Lieut. Col. J. H. Willard, Corps Engrs., U. S. A., for improving Pawtucket River by excavating rock (price given per cu. yd.). Amount to be expended,

****Items marked thus give the names of parties awarded contracts.***

$22,000. John J. Fitzpatrick, Plattsburgh, N. Y., $7.19; P. Sanford Ross, Inc., Jersey City, N. J., $10; Chas. W. Johnston, Lewes, Del., $11.50; J. K. Sullivan, Newport, R. I., $9.75, and R. G. Packard Co., New York, N. Y., $6.70.

Newport, R. I.—Only one bid was received and opened on Sept. 14 by Lieut. Col. J. H. Willard, Corps Engrs., U. S. A., for extending jetty at Point Judith Pond, and the same was submitted by E. S. Belden & Sons, of Hartford, Conn., at $1.93 per ton. Amount to be expended $9,000.

Charleston, S. C.—The following are the bids opened on Sept. 9 by Capt. G. P. Howell, Corps Engrs., U. S. A., for dredging between Charleston Harbor and Bulls Bay (estimate of quantity 257,000 cu. yds.): (*a*) dredging per cu. yd.; (*b*) piling per lin. ft.; (*c*) planking per M. ft.; (*d*) driving range piles, ea.: Chas. P. Grim, Philadelphia, Pa., *a* 31 cts., *b* 15 cts., *c* $30, *d* $3; P. Sanford Ross, Inc., Jersey City, N. J., *a* 32 cts., *b* 19.2 cts., *c* $26.90, *d* $3; Simons-Mayrant Co., Charleston, *a* 36 cts., *b* 20 cts., *c* $25; *d* $5; N. American Dredging Co., San Francisco, Cal., *a* 39 cts., *b* 20 cts., *c* $27, *d* $10.

Chattanooga, Tenn.—The following are the bids opened on Sept. 15 by Maj. H. C. Newcomer, Corps Engrs., U. S. A., for improving Tennessee River at Colbert and Bee Tree Shoals by excavating a portion of canal trunk; the bids were submitted on four different sections: (*a*) Stations 10 to 60, to contain 238,000 cu. yds.; (*b*) Sta. 60 to 110, 300,000 cu. yds.; (*c*) 110 to 160, 391,000 cu. yds.; (*d*) 160 to 210, 465,000 cu. yds.; (*e*) total: (price given per cu. yd.): J. G. White & Co., New York, N. Y., *a, b, c* and *d,* 30 cts; *e* $418,200. Christie & Lowe, Chicago, Ill., *a, b, c* and *d* 31 cts.; *e* $432,140. Roach & Stansell, Memphis, Tenn., *a, b, c* and *d,* 27.45 cts.; *e* $382,653. Shippey & Outzen, Memphis, Tenn., *a, b, c* and *d,* 17.49 cts.; *e* $243,811. Redmond & Gabbett, Atlanta, Ga., *a, b,* 24 cts.; *c,* 25 cts.; *d* 27 cts.; *e* $352,420. Northern Alabama Constr. Co., Florence, Ala., *a, b, c* and *d,* 24.24 cts.; *e* $337,906. Talley-Bates Constr. Co., Memphis, Tenn., *a, b, c* and *d,* 22 cts.; *e* $306,680. Sheridan-Kirk Contr. Co., Cincinnati, O., *a* 35 cts.; *b* 33 cts.; *c* and *d* 29 cts.; *e* $430,540.

Lynchburg, Va.—Bids will be received by the Com. on Electricity of the Common Council and Bd. Aldermen (Leon Goodman, Chmn.) until Oct. 9 for the manufacture and delivery of underground alloy-covered cables for the electric signal circuits of the fire dept. and police patrol systems; for further particulars apply to W. L. Kent, City Electrician.

Seattle, Wash.—Bids will be received until Oct. 12 by Lieut. F. A. Pope, Corps Engrs., U. S. A., for dredging Grays Harbor and Chehallis River, Wash.

PROPOSALS OPEN

For Proposals see pages 56 60, 61, 62, 63 and 64

WATER WORKS.

Bids Close.		See Eng. Record.
Sep. 26.	**Tunnel, Montrose, Colo.** Adv. Aug. 12 to Sep. 16.	**Aug. 12**
Sep. 26.	System, Boyd, Minn.	Sep. 16
Sep. 26.	Reservoir dam addition, Matteawan, N. J. Adv. Sep. 23.	Sep. 23
Sep. 26.	Water wks. extension, Lancaster, O.	Sep. 23
Sep. 28.	Tank, Vancouver Barracks, Wash. Adv. Aug. 20 to Sep. 9, 23.	Aug. 26
Sep. 28.	Water Wks., material, Floresville, Tex. Adv. Sep. 16 to Sep. 23.	Sep. 16
Sep. 29.	Filters, etc., Cincinnati, O. Adv. Sep. 2 to Sep. 16.	Sep. 2
Sep. 29.	Boiler, wells, etc., Ft. Screven, Ga. Adv. Sep. 2 to Sep. 23.	Sep. 2
Sep. 30.	**Pipe laying, Perth Amboy, N. J.**	**Aug. 26**
Sep. 30.	C.-i. pipe, Chicago, Ill.	Sep. 16
Sep. 30.	System, Newark, O. Adv. Sep. 16 to Sep. 23.	Sep. 16
Sep. 30.	Water mains, etc., Ft. Walla Walla, Wash.	Sep. 23
Sep. —	**Water Wks., E. Grand Forks, Minn.**	**Aug. 19**
Sep. —	**Water works, Jackson, Mo.**	**Aug. 19**
Sep. —	**Reservoir, McLeansboro, Ill.**	**Aug. 26**
Oct. 2.	Boiler, Homestead, Pa.	Sep. 16
Oct. 2.	Engine, Rock Island, Ill.	Sep. 23
Oct. 2.	Mains, pump, etc., Waupaca, Wis.	Sep. 23
Oct. 2.	Pipe, Oswego, Ill. Adv. Sep. 23.	Sep. 23
Oct. 3.	System, Shoshone Agency, Wyo.	Sep. 9
Oct. 4.	Boilers, Chicago, Ill.	Sep. 16
Oct. 5.	Pump plant, Ft. Worth, Tex.	Sep. 23
Oct. 6.	Water wks. plant, East Grand Forks, Minn.	Sep. 23
Oct. 9.	Distributing system, Orange, N. J.	Sep. 23
Oct. 10.	Basins, etc., Toledo, O. Adv. Sep. 16 to Sep. 23.	Sep. 16
Oct. 11.	Pipe and specials, Portland, Ore. Adv. Sep. 16 to Sep. 23.	Sep. 16
Oct. 11.	Water mains, Portland, Ore. Adv. Sep. 16 to Sep. 23.	Sep. 16
Oct. 11.	C. I. pipe, etc., Williamsburg, Pa.	Sep. 23
Oct. 12.	**Sale of standpipe, Attleboro, Mass.** **Adv. Jul. 29 to Aug. 5.**	**Jul. 29**
Oct. 13.	C. I. pipe, etc., Cincinnati, O.	Sep. 23
Oct. 13.	Filter sand and gravel, Cincinnati, O.	Sep. 23
Oct. 16.	System, Rolla, Mo. Adv. Sep. 16 to Sep. 23.	Sep. 16
Oct. 17.	Embankment, Roswell, N. M. Adv. Aug. 26 to Sep. 23.	Aug. 26
Oct. 18.	Water Wks., Milledgeville, Ga. Adv. Sep. 9 to Sep. 23.	Sep. 9
Oct. 18.	Mains, Boulder, Colo. Adv. Sep. 16 to Sep. 23.	Sep. 16
Oct. 24.	System, Ciudad Juarez, Mex.	Sep. 16
Oct. 26.	Dams, canals, etc., Belle Fourche, S. D. Adv. Sep. 2 to Sep. 23.	Sep. 2
Nov. 1.	Water wks., Waverly, Minn.	Sep. 23
Dec. 5.	Dam, Glendive, Mont. Adv. Sep. 16 to Sep. 23.	Sep. 16
Jan. 2.	Water supply, Manila, P. I.	Sep. 23
Jan. —, '06.	Water supply, Manila, P. I.	Sep. 23

SEWERAGE AND SEWAGE DISPOSAL.

Sep. 25.	Jersey City, N. J.	Sep. 23
Sep. 26.	Wenatchee, Wash.	Sep. 9
Sep. 26.	Virginia, Minn.	Sep. 9
Sep. 26.	Dayton, O. Adv. Sep. 16 to Sep. 23.	Sep. 16
Sep. 26.	Danbury, Conn.	Sep. 23
Sep. 26.	East Grand Forks, Minn.	Sep. 23
Sep. 27.	Haddonfield, N. J. Adv. Sep. 2 to Sep. 9.	Sep. 2
Sep. 27.	Brooklyn, N. Y.	Sep. 16
Sep. 27.	New York, N. Y.	Sep. 23
Sep. 27.	Chicago, Ill.	Sep. 23
Sep. 28.	Cincinnati, O.	Sep. 23
Sep. 28.	St. Paul, Minn.	Sep. 23
Sep. 28.	Dover, N. H. Adv. Sep. 23.	Sep. 23
Sep. 29.	Crete, Ind.	Sep. 16
Sep. 30.	Benson, Minn.	Sep. 16
Sep. 30.	Boston, Mass.	Sep. 16
Oct. 2.	Cresco, Ia.	Sep. 16
Oct. 2.	Lawrence, Kan.	Sep. 23
Oct. 2.	Napoleon, O.	Sep. 23
Oct. 2.	Creston, Ia.	Sep. 23
Oct. 3.	Shoshone Agency, Wyo.	Sep. 9
Oct. 3.	North Platte, Neb. Adv. Sep. 16.	Sep. 16
Oct. 4.	Gravity outlet sewer, Salt Lake City, Utah. Adv. Sep. 16 to Sep. 23	Sep. 16
Oct. 4.	Intercepting sewer and pump. sta., Salt Lake City, Utah. Adv. Sep. 16 to 23.	Sep. 16
Oct. 4.	Columbus, O.	Sep. 23
Oct. 5.	Versailles, Pa.	Sep. 23
Oct. 7.	Des Moines, Ia.	Sep. 23
Oct. 10.	Norristown, Pa. Adv. Sep. 9 to Sep. 23.	Sep. 9
Oct. 15.	Elyria, O.	Sep. 23
Oct. 16.	Cape Girardeau, Mo. Adv. Sep. 16 to Sep. 23.	Sep. 16
Jan. 12.	Manila, P. I.	Sep. 23

BRIDGES.

Sep. 26.	Mankato, Minn.	Sep. 9
Sep. 27.	Cleveland, O.	Sep. 23
Sep. 28.	Cleveland, O.	Sep. 23
Sep. 29.	Springfield, O.	Sep. 9
Sep. 29.	Spokane, Wash.	Sep. 23
Sep. 30.	San Juan, Porto Rico (2 prop.) Adv. Aug. 26 to Sep. 9.	Aug. 26
Sep. 30.	Troy, O.	Sep. 23
Oct. 1.	**Pensacola, Fla.**	**Aug. 12**
Oct. 1.	Jefferson City, Mo.	Sep. 16
Oct. 2.	Port Orchard, Wash.	Sep. 2
Oct. 2.	Peoria, Ill.	Sep. 9
Oct. 2.	Tunica, Miss.	Sep. 23
Oct. 2.	Guthrie, Okla. Ter.	Sep. 23
Oct. 2.	Peru, Ind.	Sep. 23
Oct. 3.	Bermuda, La.	Sep. 2
Oct. 3.	San Jose, Cal.	Sep. 23
Oct. 4.	**Superstructure, Chicago, Ill.**	**Aug. 12**
Oct. 4.	**Substructure, Chicago, Ill.**	**Aug. 12**
Oct. 4.	Riverside, Cal.	Sep. 23
Oct. 6.	Flandreau, S. D.	Sep. 23
Oct. 6.	Midland, S. D.	Sep. 23
Oct. 7.	Jefferson, Mo.	Sep. 23
Oct. 10.	Columbus, O.	Sep. 16
Oct. 11.	Stillwater, Okla. Ter.	Sep. 23
Oct. 30.	Camden, N. J.	Sep. 23
———	Minnesota City, Minn.	Sep. 9

PAVING AND ROADMAKING.

Sep. 26.	Cleveland Heights, O.	Sep. 9
Sep. 26.	Rye, N. H. Adv. Sep. 16 to Sep. 23.	Sep. 16
Sep. 26.	New York, N. Y.	Sep. 23
Sep. 26.	Cincinnati, O.	Sep. 23
Sep. 26.	South Bend, Ind.	Sep. 23
Sep. 26.	Chicago, Ill.	Sep. 23
Sep. 27.	Cincinnati, O.	Sep. 9
Sep. 28.	Roanoke, Va.	Sep. 16
Sep. 28.	New York, N. Y.	Sep. 23
Sep. 29.	Buffalo, N. Y.	Sep. 23
Sep. 29.	Dayton, O.	Sep. 23
Sep. 30.	Cleveland, O.	Sep. 16
Sep. 30.	Ft. Monroe, Va.	Sep. 23
Sep. 30.	Mound City, Ill.	Sep. 23
Sep. —.	Macon, Mo.	Sep. 2
Oct. 2.	Johnstown, N. Y. Adv. Sep. 16 to Sep. 23.	Sep. 16
Oct. 2.	Macon, Mo.	Sep. 16
Oct. 2.	Sykesville, Md.	Sep. 16
Oct. 2.	Jackson, Mich. Adv. Sep. 23.	Sep. 23
Oct. 3.	Paterson, N. Y.	Sep. 16
Oct. 3.	Columbus, Ga. Adv. Sep. 16, 23.	Sep. 16
Oct. 3.	Doylestown, Pa.	Sep. 23
Oct. 4.	Columbus, O.	Sep. 23
Oct. 7.	Crownpoint, Ind.	Sep. 23
Oct. 7.	Stoughton, Wis.	Sep. 23
Oct. 10.	Cincinnati, O.	Sep. 23
Oct. 14.	Washington, D. C. Adv. Sep. 23.	Sep. 23
Oct. 18.	Moundsville, W. Va.	Sep. 23
Nov. 1.	Steelton, Pa. Adv. Sep. 2 to Sep. 23.	Sep. 16

POWER, GAS AND ELECTRICITY.

Sep. 26.	Washington, D. C.	Sep. 16
Sep. 27.	Baltimore, Md Adv. Sep. 2 to 9.	Sep. 2
Sep. 27.	Utica, N. Y. Adv. Sep. 16 to Sep. 23.	Sep. 16
Sep. 27.	Chicago, Ill.	Sep. 23
Sep. 30.	Washington, D. C. Adv. Aug. 5 to Sep. 23.	Aug. 5
Oct. 1.	**Tacoma, Wash.**	**Jul. 8**
Oct. 1.	Troy, Ala.	Sep. 9
Oct. 3.	Syracuse, N. Y.	Sep. 16
Oct. 3.	New York, N. Y.	Sep. 23
Oct. 3.	Washington, D. C.	Sep. 23
Oct. 4.	Jacksonville, Fla.	Sep. 2
Oct. 4.	Ft. Leavenworth, Kan.	Sep. 16
Oct. 5.	Chicago, Ill.	Sep. 23
Oct. 10.	Supplies, Washington, D. C.	Sep. 23
Oct. 11.	Lockport, Ill.	Aug. 19
Oct. 15.	Reading, O.	Aug. 26
Oct. 16.	Ft. Monroe, Va.	Sep. 23
Nov. 1.	Chicago, Ill.	Sep. 9
Nov. 1.	Roosevelt, Ariz.	Sep. 16
Nov. 2.	Roosevelt, Ariz.	Sep. 23
Dec. 2.	San Juan, Porto Rico	Aug. 19

BUILDINGS.

Sep. 25.	Dormitory, Convent Station, N. J.	Sep. 23
Sep. 26.	Hose houses, South Bend, Ind.	Sep. 23
Sep. 26.	Bus. bldgs., Neosho, Mo.	Sep. 23
Sep. 26.	School, Detroit, Mich.	Sep. 23
Sep. 27.	Bldg. material, Poplar, Mont.	Sep. 9
Sep. 27.	Pub. bldg., Middletown, N. Y. Adv. Sep. 9 to Sep. 23.	Sep. 9
Sep. 27.	Pub. Bldg., Mitchell, S. D.	Sep. 16
Sep. 28.	School, Washington, D. C.	Sep. 2
Sep. 28.	Boiler, etc., Pub. Bldgs., Baltimore, Md.	Sep. 2
Sep. 28.	School, Amarillo, Tex.	Sep. 23
Sep. 29.	Post Bldgs., Ft. De Soto, Fla.	Sep. 9
Sep. 29.	Court house, Butler, Ala.	Sep. 23
Sep. 29.	Htg. post bldg., Ft. Warren, Mass.	Sep. 23
Sep. 29.	Engine house, etc., Jersey City, N. J.	Sep. 23
Sep. 30.	Htg., etc., pub. bldg., Washington, D. C. Adv. Aug. 5 to Sep. 23.	Aug. 5
Sep. 30.	Mess hall, etc., Washington, D. C. Adv. Sep. 2 to Sep. 23.	Sep. 2
Sep. 30.	Pub. Bldg. New York N. Y.	Sep. 2
Oct. 1.	Hospital, Memphis, Tenn.	Aug. 26
Oct. 1.	Fire headquarters, Kansas City, Mo.	Sep. 2
Oct. 2.	Repairing court house, Rosedale, Miss.	Aug. 26
Oct. 2.	Htg. jail, Cleveland, Miss.	Aug. 26
Oct. 2.	School, Pottawatomie, Kan.	Sep. 16
Oct. 2.	Schools, New York, N. Y.	Sep. 23
Oct. 2.	Court house, Marianna, Fla.	Sep. 23
Oct. 3.	Htg., etc., pub. bldg., New York, N. Y.,	Sep. 23
Oct. 3.	Library, Ensley, Ala.	Sep. 23
Oct. 3.	Pub. bldg., Buffalo, N. Y.	Sep. 23
Oct. 4.	Pub. Bldgs., Ft. Wayne, Detroit, Mich. Adv. Sep. 9 to Sep. 23.	Sep. 9
Oct. 4.	Post bldg., Ft. Riley, Kan. Adv. Sep. 9 to Sep. 23.	Sep. 9
Oct. 5.	Courthouse, Manhattan, Kan.	Aug. 12
Oct. 5.	School, Browning, Mont.	Sep. 16
Oct. 5.	Pub. bldg., Baltimore, Md.	Sep. 23
Oct. 5.	Pub. bldg., New York, N. Y.	Sep. 23
Oct. 5.	Pub. bldg., Minnehaha Falls, Minn.	Sep. 23
Oct. 10.	Court house, Enid, Okla. Ter.	Sep. 23
Oct. 12.	P. O. extension, Fargo, N. D.	Sep. 9
Oct. 12.	School, Holland, Mich.	Sep. 23
Oct. 13.	Htg., etc., Post bldgs., Ft. H. G. Wright, N. Y.	Sep. 23
Oct. 15.	Court house, Jersey City, N. J.	Sep. 23
Oct. 16.	Court house, Gretna, La.	Sep. 2
Oct. 16.	School, San Francisco, Cal.	Sep. 16
Oct. 16.	Pub. Bldgs., Sheboygan, Wis.	Sep. 23
Oct. 18.	Post Bldgs., Vancouver Barracks, Wash. Adv. Sep. 16 to Sep. 23.	Sept. 16
Oct. 18.	Post bldg., Ft. Sam Houston, Tex. Adv. Sep. 23.	Sep. 23
Oct. 20.	School, San Pedro, Cal.	Sep. 23
Oct. 25.	Pub. Bldgs., Washington, D. C.	Sep. 16
Nov. 1.	Pub. bldg. plans, Salem, Mass.	Sep. 16
Nov. 14.	P. O. bldg., Colorado Spgs., Colo. Adv. Sep. 23.	Sep. 23
Nov. 15.	School, Cleveland, O.	Sep. 16
Dec. 1.	Dwelling, Wilmington, N. C.	Sep. 16
Jan. 10.	Library plans, Toronto, Ont.	Sep. 23
Jan. 15.	Church, Riverside, Ia.	Sep. 16
———	School, Mt. Pleasant, Mich.	Sep. 16
———	School, Flandreau, S. D.	Sep. 16
———	School, Breen, Colo.	Sep. 16
———	Church, Jacksonville, Fla.	Sep. 23

MISCELLANEOUS.

Sep. 25.	Boiler, New York, N. Y.	Sep. 23
Sep. 26.	Telephone, Washington, D. C.	Sep. 2
Sep. 26.	Cement, Billings, Mont. Adv. Sep. 9 to Sep. 23.	Sep. 2
Sep. 26.	Elevators, Baltimore, Md. Adv. Sep. 2 to 9.	Sep. 2
Sep. 26.	Ditch, Van Wert, O.	Sep. 9
Sep. 26.	Supplies, Washington, D. C.	Sep. 16
Sep. 26.	Supplies, New York, N. Y.	Sep. 23
Sep. 26.	Excavating, Troy, N. Y.	Sep. 23
Sep. 27.	Telephone system, Kearny, N. J. Adv. Sep. 9.	Sep. 9
Sep. 27.	Conduit, Gowanda, N. Y. Adv. Sep. 16 to Sep. 23.	Sep. 16
Sep. 28.	Library, Reading, Pa.	Sep. 23
Sep. 29.	Dredging, Woodbridge, N. J. Adv. Sep. 16 to Sep. 23.	Sep. 16
Sep. 29.	Ditch, Rensselaer, Ind.	Sep. 16
Sep. 29.	Retain. wall, Cleveland, O.	Sep. 23
Sep. 29.	Pier, New York, N. Y.	Sep. 23
Sep. 30.	Crane track, Boston, Mass.	Sep. 2
Sep. 30.	Cement, Los Anegles, Cal. Adv. Sep. 9 to Sep. 16.	Sep. 9
Sep. 30.	Fence, Ft. Douglas, Utah	Sep. 16
Sep. 30.	Drills, etc., Panama	Sep. 23
Oct. 2.	Flag staff, Ft. Taylor, Fla. Adv. Sep. 16 to Sep. 23.	Sep. 16
Oct. 2.	Conduits, Brooklyn, N. Y.	Sep. 23
Oct. 3.	Supplies, San Francisco, Cal.	Aug. 26
Oct. 3.	Dredging, Norfolk, Va.	Sep. 9
Oct. 3.	Supplies, Washington, D. C.	Sep. 9
Oct. 3.	Dredging, New York, N. Y. Adv. Sep. 23.	Sep. 23
Oct. 3.	Canal work, Akron, O.	Sep. 23
Oct. 3.	Remov. snow, Brooklyn, N. Y.	Sep. 23
Oct. 3.	El. Ry., Cleveland, O.	Sep. 23
Oct. 3.	Supplies, Washington, D. C.	Sep. 23
Oct. 4.	Piers exten., Holland, Mich. Adv. Sep. 9 to Sep. 23.	Sep. 9
Oct. 4.	Steel cars, etc., Panama	Sep. 23
Oct. 6.	Elevator, Cincinnati, O.	Sep. 9
Oct. 7.	Pier, Boston, Mass.	Sep. 23
Oct. 9.	Dredging, Portland, Me. Adv. Sep. 16 to Sep. 23.	Sep. 16
Oct. 9.	Cables, Lynchburg, Va.	Sep. 23
Oct. 10.	Supplies, Washington, D. C.	Sep. 9
Oct. 10.	Cement, Guantanamo, Cuba. Adv. Sep. 16 to Sep. 23.	Sep. 16
Oct. 10.	Garb disp., Bridgeport, Conn.	Sep. 16
Oct. 10.	Supplies, Washington, D. C.	Sep. 23
Oct. 10.	Ditch, Marshalltown, Ia.	Sep. 23
Oct. 10.	Improv. Lock, Dresden, O.	Sep. 23
Oct. 11.	Pier, Muskegon, Mich. Adv. Sep. 16 to Sep. 23.	Sep. 16
Oct. 12.	Dredging, Seattle, Wash.	Sep. 23
Oct. 13.	Drains, Pocahontas, Ia. Adv. Sep. 23.	Sep. 23
Oct. 17.	Locomotive crane, Boston, Mass.	Sep. 23
Oct. 17.	Supplies, San Juan, P. R.	Sep. 23
Oct. 21.	Dredging, Washington, D. C. Adv. Sep. 23.	Sep. 23
Oct. 23.	Dredging Machine, Philadelphia, Pa. Adv. Sep. 16 to Sep. 23.	Sep. 16
Oct. 25.	Dock, Chicago, Ill.	Sep. 2
Oct. 25.	Wharf, Washington, D. C.	Sep. 16
Nov. 1.	Garbage franchise, New Orleans, La.	Sep. 16
Nov. 6.	Garb. disp., New York, N. Y. Adv. Sep. 9 to Sep. 23.	Sep. 2
Nov. 9.	**Wharf, etc., Havana, Cuba**	**Jul. 29**
Dec. 15.	R. R., Manila, P. I.	Sep. 16
Jan. 1.	**Statue plans, Indianapolis, Ind.**	**Jul. 22**
Apr. 2, '06.	**Harbor Work, Valparaiso, Chili,** Adv. Apr. 29 to Sep. 9.	**Apr. 29**

***Items marked thus give the names of parties awarded contracts.**